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SYNOPSIS OF THE PRACTICE OF PREVENTIVE MEDICINE

SYNOPSIS OF THE PRACTICE OF PREVENTIVE MEDICINE

AS APPLIED IN THE BASIC MEDICAL SCIENCES AND CLINICAL INSTRUCTION AT THE HARVARD MEDICAL SCHOOL

CAMBRIDGE

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1929

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PREFACE

PREVENTIVE medicine consists of two distinct phases: the protection of the health of the individual, and the protection of the health of the community. It is fitting that the regular courses in preventive medicine included in the medical curriculum should place most emphasis on the needs of the community rather than the protection of the individual.

Owing to the necessity of devoting a considerable amount of time to such broad questions as vital statistics, sewage, milk, and water, it is impossible to consider in detail the protection of the individual. Furthermore, any such course is more or less naturally regarded by the students as a subject apart, and tends to be kept by them distinct in their minds from medicine, surgery, obstetrics, or other clinical branches.

The faculty of the Harvard Medical School adopted in 1925 the policy of infiltrating the curriculum with preventive medicine, so that the student was practically unconsciously absorbing the ideas of preventive medicine along with the other matters to which he was devoting his attention. Perhaps best in such a way as this can correlation be obtained, and the student trained to consider the preventive aspects together with the clinical. The already overcrowded curriculum is not further burdened, as often a minor shift of emphasis or a sentence or two added to the material will serve to give the points needed. Frequently it serves to make more interesting the material already in hand; for example,

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the matter of surgical technique so often taught empirically can be livened by an explanation of the needs for the methods employed and their value.

The present volume was not conceived as a text or reference book, but merely as a depository for such points as seemed of possible value in emphasizing, in connection with the present curriculum of the Harvard Medical School, the importance of preventive medicine for the practitioner. The various chapters represent the composite ideas of many members of the faculty, and stress those prophylactic measures that should help the doctor in protecting the health of his patients.

The editor will appreciate any suggestions which might increase the usefulness of the material. To facilitate emendation and criticism, an interleaved form of binding has been adopted.

The editor is glad to express his indebtedness to the many members of the faculty of the Harvard Medical School who have given of their time and interest to this project, and without whose coöperation in clinic and amphitheater the preparation of this synopsis would have been futile. He wishes to acknowledge particularly the help and guidance of Drs. D. L. Edsall, H. A. Christian, E. D. Churchill, E. A. Locke, F. S. Newell, R. B. Osgood, M. J. Rosenau, R. M. Smith, H. Zinsser, and the late Dr. Francis W. Peabody.

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ABBREVIATIONS

Am. Jour. Anat.	American Journal of Anatomy.
Am. Jour. Dis. Child.	American Journal of Diseases of Children.
Am. Jour. Pub. Health	American Journal of Public Health.
Am. Rev. Tub.	American Review of Tuberculosis.
Ann. de l'Inst. Past.	Annales de l'Institut Pasteur.
Arb. a. d. k. Gsndhtsamte.	Arbeiten aus dem kaiserlichen Gesundheitsamte.
Arch. Int. Med.	Archives of Internal Medicine.
Arch. Otolaryng.	Archives of Otolaryngology.
Berl. klin. Wchnschr.	Berliner klinische Wochenschrift.
Boston Med. and Surg. Jour.	Boston Medical and Surgical Journal.
Br. Med. Jour.	British Medical Journal.
Bull. Rockefeller Inst.	Bulletin of the Rockefeller Institute.
Centralbl. f. Bakt.	Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten.
Deutsch. med. Wchnschr.	Deutsche medizinische Wochenschrift.
Ind. Med. Gaz.	Indian Medical Gazette.
Jour. Am. Med. Assoc.	Journal of the American Medical Association.
Jour. Exp. Med.	Journal of Experimental Medicine.
Jour. Hyg.	Journal of Hygiene.
Jour. Ind. Hyg.	Journal of Industrial Hygiene.
Jour. Lab. and Clin. Med.	Journal of Laboratory and Clinical Medicine.
Jour. Med. Res.	Journal of Medical Research.
Jour. Roy. San. Inst.	Journal of the Royal Sanitary Institute.
Monogr. Rockefeller Inst.	Monographs of the Rockefeller Institute.
Münch. med. Wchnschr.	Münchener medizinische Wochenschrift.
N. E. Jour. Med.	New England Journal of Medicine.
Physiol. Rev.	Physiological Reviews.
U. S. Hyg. Bull.	United States Hygiene Bulletin.
U. S. Nav. Med. Bull.	United States Naval Medical Bulletin.
U. S. Public Health Report	United States Public Health Report.
Wien. klin. Wchnschr.	Wiener klinische Wochenschrift.

INTRODUCTION

For generations there has been a slow accumulation of improved knowledge concerning the early diagnosis and treatment of disease and the control or prevention of the progress of disease. A new type of action was opened a century and a half ago, when the essential methods of real prevention, as well as of control, of scurvy were demonstrated. A little later the same was done with smallpox. It was long before these were extensively used, but in regions where they were properly employed they almost wiped out those diseases. Further additions to definite and reliable knowledge of actual prevention were, however, few, and for many years were not highly important. In the past half-century, however, a vast amount of work, especially in bacteriology, parasitology, and nutrition, but also in other lines, has led to a massive accumulation of reliable information in these subjects, certain parts of which can now in very important and diverse ways be effectively applied in specific methods of prevention. During the same period less specific but valuable measures that increase resistance to disease, that prevent the access of disease-producing agents, or that eliminate other forms of hazard have been greatly enlarged in number and much improved in character.

Much remains still unknown or unsatisfactory, but methods of prevention that are now available are recognized by intelligent persons to constitute a highly im-

portant part of what the practitioner should be putting into effect in his daily practice. Public health authorities, practitioners, medical educators, and lay persons agree that the training of physicians in the daily employment of preventive measures as a wholly natural part of their work, in the same spirit that they have always used curative measures, is now of great importance to public welfare. In spite, however, of much that has been said and written on this, there has been in most medical schools little progress in altering the general influence of the teaching from one that has curative measures alone as the dominant object in view to one in which preventive measures stand out equal to practice in force and pertinence.

There are some quite obvious reasons why this should be true. Perhaps the most important is the fact that only a small proportion of those now engaged in the practice or the teaching of medicine had in their training any systematic instruction in even the principles of real preventive medicine, and those who have had are chiefly persons under forty years of age. Still fewer have had any instruction except in rather casual and slight ways in the practical application of preventive measures to practice. There have, therefore, been few, and there still are few, among those who teach in medical schools who have had sufficient knowledge of the relations of their subject to preventive medicine to be able to make any serious attempt to teach those relations at all systematically. Where taught at all, preventive medicine has been taught with emphasis or system almost entirely in one department especially provided for that purpose. It has not usually penetrated extensively into the other departments and especially

into the clinical departments where its applications in practice must be made.

In the last decade or two, however, a slowly increasing number have grown interested in this and have informed themselves in those aspects of preventive medicine that influence their own work. They have thus gained the knowledge and the interest that have led them to teach this as a live and important part of their work. In this Medical School during the past fifteen years considerable attention has been devoted to the preventive aspects of pediatrics, obstetrics, mental diseases, orthopedic surgery, venereal disease, and, in general medicine, to the industrial and economic causes of disease, and to the more or less specific aspects of the control of infections and of certain nutritional diseases. In still other departments there has been for some time a growing interest. In almost all departments one or more teachers have devoted much time and study to the preventive features of their work and have become well able to put them in systematic form so that they might be available in print for other teachers to develop their own knowledge or for students to use in reading and study. Heretofore there have been authoritative books covering the scientific and public health aspects of the subject, but the practical applications have never been systematically put together. In some part they have been in print, but scattered through journals or books of diverse kinds; in large part they have been only in the minds of individuals. They were in no way available in orderly and accessible form if teachers or students wished to clarify points or to refresh the memory.

We undertook to get together a brief summary of the pertinent things relating to prevention that each department felt could and should be taught in that department. The clinical departments were, of course, most prominently in view, but in all the medical sciences opportunities to emphasize prevention and to give it its due place in the future practitioner's mind frequently offer. Hence this collection represents each department of the School. It provides essentially a small, collective textbook of general practice of preventive medicine, and is intended to further the permeation of the whole curriculum with the atmosphere of preventive medicine equal in strength to that of curative medicine. In carrying this out, purely preventive measures have been blended with those that check or control the progress of slight or early chronic disease. The two often cannot be separated and there is no true line between them.

A first attempt at so diffused and complex a new purpose is necessarily faulty. This effort is recognizedly imperfect, but the imperfections can be met better through use of this volume in a critical way than by further elaboration before printing. This first printing is interleaved in order to facilitate comments as to desirable additions or subtractions as well as criticisms.

It is hoped that it will prove useful in this and in other schools, and that any alterations that teachers or practitioners here or elsewhere may feel desirable will be freely brought to our attention in order that the book may be made more serviceable as time goes on.

Some one or more members of each department have devoted very considerable time and thought to the preparation of the material, and it represents the School as a whole. Dr. Shields Warren was asked to undertake

the editorial work, and, in many instances, has taken data put together by the departments and put them into systematic order for publication, so that his has been the chief labor.

DAVID L. EDSALL, M.D.

SYNOPSIS OF PREVENTIVE MEDICINE

I

ANATOMY

To bring to the attention of the student some of those aspects of preventive medicine bearing on anatomy, it is perhaps simplest to consider them with relation to the systematic arrangement of the course.

In connection with osteology there are a few points worthy of mention. Thus, the changes in bone produced by rickets are obvious and of considerable importance, and it is easy to give brief mention to the prevention of rickets by feeding of cod-liver oil, together with exposure to an adequate amount of sunlight or ultraviolet radiation.[1] At the same time it might be well to discuss the bony deformities which may be produced by the premature bearing of weight by the bones of infants. Another consideration, rare but of some interest, particularly from the point of view of the orthopedic surgeon, is the danger of separation of the epiphyses before their union, due to extra stress upon them. This is particularly apt to occur in rather obese children presumably with endocrine disorder.[2] The necessity of an adequate supply of calcium to the mother in pregnancy and lactation is also worthy of consideration. In connection with the structure of bones, particularly the long bones, the avoidance of disastrous results by the proper treatment of osteomyelitis should be emphasized, and

[1] Park, E. A. *Physiol. Rev.* **3**: 106, 1923.

[2] Wilson, P. D. and Cochrane, W. A. Fractures and Dislocations, p. 479. (Philadelphia, 1925).

at the same time the function of the periosteum may be rather vividly brought out.

The spinal column offers several specific instances of the value of preventive measures. Probably the most important of these is the necessity for correct posture to prevent back strain, scoliosis, or kyphosis. In relation to this it might be well to bring out the effect of improper posture in changing the stress on bones and thus producing a progressive deformity until equilibrium is once more reached.[3] Again, the weight-bearing function of the spinal column may be emphasized by touching on the deformity resulting from destructive processes in the vertebrae, such as Pott's disease, and (as a corollary) the need for removal of weight from the affected vertebrae in order to prevent deformity.

In consideration of the muscular system again there are certain general aspects as well as local considerations. The advantage of exercise in establishing and maintaining proper tonus is worthy of mention, and, in particular, there should be stressed the importance of correct posture in avoiding undue or unequal muscle strain. Especially in people in industry and in growing children this is a fruitful source of many annoying disorders. In bringing out the function of the muscles it is perhaps worth while to mention the importance of allowing for action of opponents and of preventing contraction deformities in connection with fractures, tendon sutures, and the like. Finally, care in the use of splints and casts to prevent ischemic contractures should be touched upon.

There are certain special regional considerations also. With regard to the abdominal muscles the importance

[3] Koch, J. C. *Am. Jour. Anat.* **21**: 289, 1917.

of maintaining proper tonus to avoid ptosis and constipation is obvious. Again, from the standpoint of practical surgery it is well to consider the importance of conserving the muscles in abdominal incisions in order to prevent postoperative herniae. Herniae may be considered in relation to the muscles of the inguinal regions, particularly with relation to avoidance of undue exertion as a possible cause, as well as the necessity of care of herniae to avoid strangulation. The great importance of muscles of the perineum in the female, and the need for prompt repair of birth injuries, may be stressed.

Under the nervous system, most points of importance will be covered in other courses. However, it would perhaps be well to associate with the brachial plexus the importance of care in the delivery of infants to avoid rupture of the nerve roots and consequent paralysis.

In splanchnology, practically all points will be touched on later in the curriculum.

In connection with general consideration of the thorax there are a number of points: first, the prevention of deformities due to rickets or scoliosis; second, the danger of respiratory infections because of decrease of vital capacity through deformity (small size of the thoracic cage predisposes to respiratory infections, particularly tuberculosis); third, the importance of prompt drainage of intrapleural fluid to avoid collapse of the lung and to increase vital capacity.

In consideration of the extremities there are a number of points of practical value. With regard to the wrist, for example, there is the importance of correct approximation of tendons severed by injury and the maintenance of physiological position of dorsal flexion

at the earliest moment consistent with the healing of the injured structures, together with the importance of median and ulnar nerves in nerve sutures. One of the general considerations of importance is the choice of sites of amputation and the underlying reasons determining the choice, such as avoidance of leaving a stump unwieldy or incapable of weight bearing, or incapable of receiving sufficient vascular supply.

The hand affords several striking instances of the value of preventive medicine, particularly with relation to infection. Thus, the prompt treatment and drainage of any infection near the synovial sheaths should be stressed, as should also the importance of prompt drainage of infections beneath the palmar aponeurosis, and care of any puncture wound through it.[4] In considering the leg, the prevention of varicose veins by maintenance of muscular activities and avoidance of constricting bands about the leg may be emphasized. With regard to the foot, the two most important features are the prevention and correction of flat foot, and the avoidance of deformities due to poorly fitting shoes, such as bunions, hammertoes, corns, and the like, which give rise to a degree of discomfort altogether disproportionate to their anatomical importance.

There are certain points in the anatomy of the head that have a very distinct bearing on preventive medicine, such as the relation of the middle ear to the mastoid cells and the lateral sinus and the consequent danger, in otitis media, or the possible production of mastoid infection, septicemia, or brain abscess. In connection with the nasopharynx there are again anatomical peculiarities of importance, such as the need for removal of

[4] Kanavel, A. B. Infections of the Hand. Philadelphia, 1916.

adenoids large enough to cause obstruction, and the changes in the anatomical structure of the face due to the prolonged presence of adenoids, thus giving rise to the so-called adenoid facies. In addition, the importance of avoiding infection of the accessory sinuses can be easily touched upon, as can the means for providing drainage after infection occurs. Incidentally, the importance of the air sinuses in the resonance of the voice can be well brought out, together with the need for correction of such embryological defects as cleft palate.

Finally, at least passing mention of the importance of the relation of the lymphatics to preventive measures may be touched upon. The need for checking and properly draining infections before the regional lymph nodes are passed is a measure of obvious importance. With regard to cancer, the importance of the lymphatics as channels of dissemination may be stressed and the consequent necessity for the radical type of operation can be well brought out.[5]

[5] Ewing, J. Neoplastic Diseases. Philadelphia, 1928.

II

PHYSIOLOGY

Physiology, dealing as it does with the normal activities of the human organism, affords many opportunities for considering points of practical importance in preventive medicine. However, since medical students have had no contact with clinical work when given the course in physiology, it is not possible for them to grasp all the implications presented by the subject.

In the study of the physiology of muscles and nerves, many points of practical value from the standpoint of prevention of disability and disease appear. Fatigue is known to be one of the most important factors in lowering the resistance of an individual to infection and in interfering with proper bodily function. The deleterious effects of fatigue on the nervous system and on the general condition of the organism are familiar to all from their own experience. An understanding of the importance of fatigue and of means of preventing or lessening it is obviously important for the prevention of disease. There are many physiological experiments dealing directly with this point, such as the effect of prolonged work without rest periods in lengthening the period of recuperation out of proportion with the amount of work actually done. The value of alternating periods of work and rest can very readily be illustrated.

In connection with the study of reflex acts, it is relatively simple to call attention to their importance in the prevention of fatigue and their relation to the conservation of the strength of the individual, particularly

in industry, where repetitive acts are of great importance. In this connection, emphasis may also be placed on the value of simplicity of pattern of motion in the prevention of fatigue. A corollary to this is the value of training in economizing of effort through making acts more or less reflex, in adapting muscles to the presence of fatigue products, and finally in causing an actual hypertrophy of muscle fibres, hence endowing them with greater power of contraction.

While invading the field of psychology to a slight extent, the relation of habit formation to conditioned reflexes deserves attention.

It is perhaps not sufficiently emphasized that posture, good or bad, depends more on the central nervous system than on bones and muscles. Thus the training of the individual, particularly in childhood, in good postural habits is of definite value in preventing functional or even organic disorders.

At the same time neuro-circulatory asthenia may be considered, and the importance of proper posture, muscle tone, and nervous control emphasized in relation to it.

In connection with the study of smooth muscles and muscle tonus, the effect of excessive work and emotional disturbances may well be called to the attention of the student, with emphasis on their rôle in lowering the tonus of the musculature of the digestive tract, and consequent interference with digestive function. The importance of regularity in function of the digestive tract is obvious.

Diet should be considered not only from the caloric standpoint but from the qualitative standpoint as well. The prospective practitioner of medicine must be famil-

iar not only with the obvious ill effects of inadequate dietaries but with the more insidious disorders secondary to insufficient or ill-balanced rations.

We need to keep in mind certain general standards which will serve to guide us in the necessary deviations from the normal diet in the course of disease. It is essential to remember that there are also intrinsic factors in disease that are of great importance. Thus, the speeding up of metabolism in fever demands a higher caloric intake than would otherwise be necessary. However, we must constantly be ready to deviate from our assumed standard because of dangers that may be even greater than an excess or deficiency in the diet; that is, diet should be considered from the standpoint not only of the energy exchange of the individual but also of the individual as a whole and of the disease process attacking him.

It is hardly necessary to touch on the relative values of foods, of the value of carbohydrates as a source of energy, of fats likewise, and of the usefulness of proteins in supplying the necessary amino acids for growth and for repair of damaged tissue. The work of Woodyatt and others on the antiketogenic function of carbohydrates is of great practical importance to every physician. Frequently the salt content of a diet may be overlooked.

From the aspect of maintaining individual health and proper physical condition the three points that need most careful consideration are: too low a diet, too high a diet, and a diet deficient in the vitamins. Too low a diet, seen most frequently in young women striving for a thin figure, results in loss of resistance to disease processes and also loss of strength and energy. The effects of diets well below normal caloric intake in lowering

activity, both physical and mental, are thoroughly established. On the other hand lies the danger of overeating and obesity, more common in older individuals as the amount of physical exercise taken by them is low. Obesity is the almost inevitable result of overeating, and while the association of various diseases with obesity is perhaps not absolutely proved, nevertheless the predisposition to diabetes and to arteriosclerosis is too obvious to be disregarded.

Once the diet of the individual has been corrected from the quantitative standpoint, the next point is the qualitative. Far too frequently carbohydrates have an abnormal predominance in the diet at the expense of proteins. The value of a balanced diet is too well known to need comment.

The various vitamin deficiencies are more important in childhood owing to more active growth at that period. Large groups of our adult population still suffer from pellagra, again a disease which may be prevented or corrected through proper diet.

When the physiology of the eye is considered there are many opportunities for pointing out the measures which have an important bearing on the conservation of vision and its efficiency: first, the importance of adequate and properly directed light, in order to avoid eyestrain; second, the avoidance of glare so far as possible; third, the use of properly fitting glasses to correct any defects that may exist and prevent their further progression. Finally, color blindness should be recognized as a great risk, particularly in those persons in any way dependent on the use of colored signals, and the importance of detecting this condition as one means toward accident prevention should be brought out.

Hearing is the only other of the special senses having a particular relationship to prevention of disease. The ill effects on the ear of long-continued and excessive noise in industry are worthy of mention. The rôle of any continuous noise as an unrecognized source of nervous fatigue should be touched on.

Respiration is one of the most important subjects from the standpoint of physiology, and one very well adapted to the inculcation of some of the possibilities of preventive medicine. Thus, the need of proper ventilation may be discussed: first, the maintenance of an adequate supply of oxygen; second, the removal of waste products, and, of special importance in industry, the removal of injurious dusts or acid fumes; and, finally, circulation of the air as an aid to comfort. In addition, the proper temperature and moisture content of air deserve careful consideration. In the first place, if the air is too hot it is usually too dry as well, and both these conditions definitely predispose to respiratory infections and also to abnormal sensitivity to cold. Leonard Hill's work on air temperature in relation to the nasal mucosa is particularly apt. On the other hand, if the air is too cold, constant activity is necessary to prevent discomfort. Especially if the humidity is high, discomfort rapidly appears and the onset of fatigue is much more rapid than under proper conditions.

The danger of carbon monoxide poisoning should be recognized, owing to the occurrence of large amounts of the gas in automobile exhausts and the widespread use of illuminating gas for all household purposes. This particular poison may well be considered in detail as an illustration of oxygen want. The physiological effect of the gas may be correlated with the means of preven-

tion of disability or death from this widely dispersed and insidious poison. In the laboratory the various methods of artificial respiration and resuscitation should be considered. The students may well be thoroughly drilled in the Schaeffer prone pressure method of artificial respiration. Many practitioners of the present day have all too little knowledge of the most efficacious methods of resuscitation. Prevention of death from drowning and electric shock, as well as from gas poisoning should be considered. In this connection it would be well to consider the limitations of the various mechanical devices for artificial respiration, because the average lay individual and most physicians have a very exaggerated opinion of the value of the majority of machines of this type. As a further emphasis on the practical importance of carbon monoxide, a demonstration of Henderson's Oxygen-Carbon-Dioxide Apparatus for artificial respiration could be given in connection with the laboratory work.

While there are a number of other opportunities for laying emphasis on preventive medicine present in the field of physiology, it is perhaps better to rest with these few than to attempt to go too far afield.

III

PATHOLOGY

Since the courses in pathology and bacteriology are presented to the students at the same period in the curriculum and an attempt is made to correlate the two courses, it is perhaps advisable to restrict the teaching of preventive medicine with respect to the course in pathology to those diseases not due to specific infectious organisms, as these are adequately considered in bacteriology.

In the early part of the course, during the consideration of the various injurious agents, it is easy to touch briefly on measures for avoiding the less obvious of them, such as proper protection of patient and operator to avoid radium and X-ray burns,[1] the danger of overheating hot-water bottles to be used by debilitated or unconscious patients, and the like.

When the repair processes are being discussed, the difference in healing of infected and noninfected wounds and consequent importance of avoiding infection can be tellingly brought out. The value of drainage of infected material and the necessity for *débridement* of wounds may be easily emphasized.[2,3] A further illustration of this point is afforded by osteomyelitis, with the danger of delay in establishment of drainage and the hindrance to healing by the presence of the sequestrum.

In addition, it is easy to illustrate the connection between the need for proper blood supply and the choice

[1] Wolbach, S. B. *Jour. Med. Res.* **21**:415, 1909.
[2] Pool, E. H. *Jour. Am. Med. Assoc.* **73**:383, 1919.
[3] Lewis, D. *Ibid.* **73**:377, 1919.

of sites of election in amputation. In connection with thrombosis, the value of rest in bed in conditions under which thrombosis is likely to arise, such as pregnancy, can be brought to the student's attention as tending to minimize the danger of embolism.

Unfortunately, we have too little accurate data as to the causation of the chronic diseases and consequently we are more or less at a loss when it comes to considering their prevention. However, the prevention of untoward events or complications in the course of these diseases can be brought out and the generally accepted measures for combating them may well be touched on. Thus, in the consideration of arteriosclerosis the possible etiological rôle of obesity, high protein diet, or excessive mental and physical strain may be considered.

From our knowledge of the association of hypertension and arteriosclerosis it is obvious that one source of arteriosclerosis may be minimized by early and adequate care of high blood pressure. The association of diabetes and arteriosclerosis [4] is so striking as to suggest that great care in maintaining the blood sugar level as near normal as possible, and in keeping diabetic patients from gaining too rapidly, preferably in keeping them a little under weight, is of definite value in reducing the incidence of arteriosclerosis arising on a diabetic basis.

In addition, emphasis may be laid on the prevention of complications arising in the course of arteriosclerotic disease, such as cerebral hemorrhage and anginal attacks.

In considering myocardial degeneration, the value of antitoxin in preventing diphtheritic injury may well

[4] Joslin, E. P. The Treatment of Diabetes Mellitus (4th ed.). Philadelphia, 1928.

be mentioned, although so far as frequency of occurrence is concerned the so-called chronic vascular myocarditis encountered in the older age groups is far more important. In connection with this last lesion it may be pointed out that while there is no known way of averting the condition, at least its more serious consequences may be put off for a time by avoiding undue exertion and endeavoring to live within the factor of safety of the heart. In addition, the value of digitalization in preventing chronic passive congestion and general anasarca may be touched on.

In the consideration of the lungs, the need for proper ventilation, especially in industry, is a point of value in the prevention of pneumoconiosis [5] or tuberculosis. It is perhaps worth while to bring out the importance of prompt drainage of empyema, and the dangers from toxemia and to a lesser degree from decreased vital capacity arising from its neglect. The relative frequency of empyema necessitatis outside of the large hospitals is far too great.

Our knowledge of gastro-intestinal tract lesions other than the acute infections is too meager. However, some attention should be devoted to hemorrhoids as a frequent source for secondary anemia, even to a severe degree. Fistula in ano is in some cases due to neglected hemorrhoids. The prophylaxis and even treatment of hemorrhoids themselves is not difficult; they usually can be prevented by regularity in bowel habits and the avoidance of undue straining. In this connection regularity is particularly important during pregnancy, as this condition in itself entails some venous obstruction. Of course in such conditions as cirrhosis of the liver

[5] Winslow, C.-E. A., and Others. *Public Health Reports* **34**:1171, 1919.

with interference with the portal circulation their presence is unavoidable.

Our knowledge of the liver and its diseases is only sufficiently accurate to afford an opportunity for consideration of a few prophylactic measures. It might be well, however, to mention the danger of hemorrhage that a jaundiced patient may present in any surgical operation. The not-infrequent rôle of the gall bladder as a focus of chronic infection is worthy of passing attention. Frequently in diabetes there is a marked improvement in the sugar tolerance of the patient after the removal of an inflamed gall bladder.[6]

In the consideration of the pancreatic diseases, the possibility of preventing at least a few cases of acute pancreatitis by prompt operation for gall-stones when indicated should be brought out, as occasionally this condition can be traced to the neglect of cholelithiasis.[7] In this same connection, clinical experience has shown that diabetic patients frequently give evidence of gall bladder disease and improve materially when the pathological conditions in the gall bladder have been corrected. The most important disease associated with the pancreas is diabetes mellitus. In considering this disease it is worth while to emphasize the possible etiological rôle of obesity and the danger of an excessively high carbohydrate intake. At the same time it would be possible to point out the greatly increased susceptibility of the diabetic patient to intercurrent infections and the importance of measures designed to protect him from them.

[6] Joslin, E. P. The Treatment of Diabetes Mellitus (4th ed.). Philadelphia, 1928.

[7] Opie, E. L. Diseases of the Pancreas (2d ed.). Philadelphia, 1910.

The kidneys offer a number of possibilities for teaching preventive medicine. In the first place, the dangers of back pressure from obstruction lower down in the genito-urinary tract may be brought out. Again, the importance of protecting the kidneys in certain of the acute diseases such as diphtheria and scarlet fever can be readily stressed. In the consideration of nephritis itself, however, our knowledge hardly goes far enough to warrant any positive statements of value, and inasmuch as these diseases are considered in some detail in the course of clinical instruction later on, it might be well to defer the consideration of preventive measures until they are taken up in the course of the clinical studies.

An obvious prophylactic measure is the removal of an obstructing prostate to prevent back pressure on the kidneys, and it might well be pointed out that it is advantageous to operate before the resistance of the patient has been too far broken down by the condition. The danger of infection of residual urine is a rather important point, whatever the cause of retention. While perhaps not dealing immediately with pathology, the need for prompt investigation of hematuria cannot be too often stressed.

In the consideration of the diseases of the endocrine glands there is not much that can be said with regard to preventive measures. However, the use of iodine in goiter regions as prophylaxis against endemic goiter [8] should be mentioned and warning should also be given against its overenthusiastic use. In connection with iodine therapy its value in reducing operative risk in exophthalmic goiter might be brought out. In any

[8] Marine, D., and Kimball, O. P. *Jour. Lab. and Clin. Med.* 3: 41, 1918.

mention of thyroidectomy the danger of excision of the parathyroids deserves passing comment.

Among the most important subjects of pathology are the neoplastic diseases. Owing to our ignorance of the etiology of the various malignant diseases our prophylactic measures are of necessity purely empirical. They may be divided into two major groups: first, those concerned with the causation of tumors; and second, the early diagnosis and treatment of suspicious lesions. Under causation we may work, or rather grope, on the basis of the chronic irritation theory.[9] Thus, in the skin, warty growths other than the common infectious type should be removed either by excision or radiation. It is probably advisable to remove pigmented moles in regions subject to irritation, and certainly advisable to remove them if they show growth or ulceration. Scaling patches and small ulcerated areas should be kept clean and protected from wind and weather as well as from mechanical irritation. If the scaling patch develops into a true keratosis, particularly of the advanced type, excision or radiation of it is absolutely essential. Efforts should be made to heal chronic ulcers of all types, such as lupus or varicose ulcers, and if healing is not possible a careful watch should be kept on them for degenerative changes, particularly at their margin.

The prevention of X-ray and radium burns[10] in both doctor and patient seems so obvious as to need but little comment, but from time to time accidents occur which illustrate the importance of education in the dangers of radiation therapy.

[9] Ewing, J. Neoplastic Diseases (3d ed.). Philadelphia, 1928.
[10] Wolbach, S. B. *Jour. Med. Res.*, **21**: 415, 1909.

In new growths of the mouth cavity it is important to consider the various causes of chronic irritation and to minimize their effects. Thus, tobacco users should give particular attention to the cleanliness of the mouth cavity. Sharp or jagged teeth or badly fitting plates should be immediately removed. Careful treatment should be instituted for pyorrhea and for root sinuses. Perhaps one of the most important of the precancerous conditions in the mouth is leukoplakia, which should never be allowed to persist untreated.

In the intestinal tract, the danger that rectal polyps may become malignant is very real, and is of sufficient importance to warrant prophylactic removal of them. Of course the prompt investigation of any change in digestive habits of those over thirty-five, should be stressed in an effort promptly to establish diagnosis of malignancy.

One of the most important types of carcinoma in women is carcinoma of the cervix. Certain of the cervical cases, no matter how early diagnosed, and treated, will die; others, in the early stages at least, respond very satisfactorily to treatment. Therefore, early diagnosis, particularly prompt investigation of any metrorrhagia or menorrhagia, is important. Since many of the cervical cancers arise on a basis of erosions or lacerations, the repair of birth injuries and the adequate treatment of leukorrhea is in the highest degree essential.

There are certain general considerations also that deserve at least passing mention. Among these are the minimization of the dangers from irritants to workers in chemical substances, particularly the tar and aniline groups.

In addition, there may well be stressed the importance of early diagnosis of tumors to permit the institution of effective therapeutic measures, and the importance of frequent examinations to detect recurrence of the disease after it has once been treated.

IV

BACTERIOLOGY

One of the most important applications in bacteriology is that of the destruction of microörganisms. On this depends practically all of the modern practice of surgery and much of our mass sanitation. While there are a large number of agents that are harmful to bacteria, they vary markedly in their effect and in their penetrating power.[1] There are a number of terms rather loosely used which it is perhaps of value to redefine. These are: sterilization, the complete destruction of bacterial life; disinfection, the complete destruction of bacterial life by chemical agents more particularly; incomplete sterilization, which kills vegetative forms leaving spores uninjured; and antiseptic agents, which inhibit the growth and multiplication of microörganisms.

I. Sterilization

Fortunately for mankind there are many physical as well as chemical agents which exert deleterious effects upon microörganisms. Among these are desiccation, which destroys cholera vibrio, for example, within four hours. However, the spore forms of bacteria exist for months or even years under ordinary conditions. Light is a valuable germicide, particularly direct sunlight. Thus the tubercle bacillus is killed within two hours by direct sunlight. It has been shown by careful investigation that the power of ordinary light to destroy organ-

[1] Ford, W. W. Textbook of Bacteriology. Philadelphia, 1927.

isms is due almost entirely to the ultra-violet end of the spectrum. The rays of X-ray and radium are far less effective than are those of ultra-violet light. Electricity, so far as its direct effects are concerned, is of little value. Heat is the most valuable of all the physical agents for sterilization.

In the application of all agents there are two factors which must be reckoned with: first, the intensity with which the factor acts; and second, the length of time over which it acts. In heat, the relationship of these two factors is peculiarly simple. Thus it is quite possible by the prolonged application of relatively low temperature to obtain the same effect as by a much shorter application of higher temperature. Moist heat is far more effective than dry heat. Moreover, the power of penetration of moist heat is far better than that of dry heat. Moist heat can be used either as boiling water or as steam. Steam is used under varying degrees of pressure ranging from streaming steam to twenty or twenty-five pounds pressure in practical applications. The methods of heat sterilization may be summarized as follows:

1. Burning, which implies the total destruction of infected material.

2. Hot air sterilization, the air being heated to 150°–160° Centigrade for an hour.

3. Moist heat, used chiefly in the form of boiling water, five minutes usually being sufficient for the destruction of vegetative forms and an hour being required for the destruction of all spores. The addition of 1 per cent sodium carbonate or 2 per cent carbolic acid to the boiling water very greatly increases its efficiency. A modification of this type is seen in the so-

called fractional method, where the objects to be sterilized are exposed to streaming steam rather than steam under pressure for one hour on three successive days. This is based on the theory that the existing vegetative forms will be killed and that in the intervals between sterilizations the various spores will have become vegetative forms.

4. Steam under pressure, the most powerful of heat disinfectants short of burning, is applicable to the sterilization of almost any type of material not injured by moisture. Exposure to fifteen pounds of steam pressure for twenty minutes is sufficient to kill vegetative forms and spores, with the possible exception of one or two thermophilic species.[2]

Chemical agents injurious to bacteria cover a tremendous range varying from simple metallic salts to the most complicated of organic compounds. These chemical agents act in many ways, such as in rapid oxidation of the protoplasm, coagulation of protoplasm, chemical combination between the protoplasm and some toxic substances causing death. It has been shown by Chick that the killing of bacteria by disinfectants progresses at a rate characteristic of the mathematical expression for velocity of monomolecular chemical reactions. A number of the halogen compounds are widely used, such as chloride of lime, and various other substances dependent on a somewhat similar mixture, such as Dakin's solution. Other important halogens are iodine in the form of tincture, and iodoform. There are many proprietary compounds dependent on the activities of halogens ranging from very satisfactory preparations

[2] Esty, J. R. Article in The Newer Knowledge of Bacteriology and Immunology, p. 285. Chicago, 1928.

to the wildest of quack preparations. Peroxide of hydrogen and permanganate of potash are fairly efficient but in the lay mind, at least, very considerably overrated. The alcohols of various types are relatively inefficient. Thus anthrax spores will remain alive for four months in either absolute or 50 per cent ethyl alcohol. The vegetative forms, however, are killed fairly rapidly, especially if the concentration of alcohol ranges from 50 per cent to 70 per cent; 95 per cent or absolute alcohol is far less efficient. Carbolic acid and the entire phenol group, particularly the cresols, are very important, and carbolic acid has been adopted more or less by common consent as a standard for comparing the efficiency of other preparations. Formaldehyde is one of the substances used in the gaseous form as a disinfectant, and in solution as a germicide and preservative. A number of the dyes, particularly those of the flavine group, have been utilized for disinfectants. Acriflavine is very popular as a skin disinfectant in surgical practice. Among other dyes may be mentioned gentian violet[3] and malachite green. The number of the various types of disinfectants is far too great to be covered in a discussion of this type and must be passed over with this rather inadequate discussion.

As has already been said, the method of testing the efficiency of antiseptics is based on the carbolic acid coefficient test originally described by Rideal and Walker.[4] The method of obtaining the coefficient is as follows: Dilutions of carbolic acid and the disinfectant to be tested are prepared for testing on suspensions of the same species of bacteria, and the dilution of the

[3] Churchman, J. W. *Jour. Am. Med. Assoc.* **79**: 1657, 1922.
[4] Rideal, S., and Walker, J. T. A. *Jour. Roy. San. Inst.* **24**: 424, 1903.

antiseptic to be tested which kills the bacteria as does a given dilution of carbolic acid is determined. To obtain the result the dilution of the disinfectant is divided by the effective dilution of carbolic acid. It must be remembered, however, that these tests are not absolute since most organic fluids contain protein, mucin, etc., markedly changing the efficiency of various substances.

Among the gaseous disinfectants should be mentioned nascent oxygen or free oxygen, which is markedly inhibitive to all strictly anaërobic organisms. Dry ozone is entirely inefficient, but ozone passed through fluids has a marked destructive effect on bacteria. Chlorine is inefficient in the dry state. Sulphur dioxide is of relatively little value except for disinfection, the best concentration being the amount of gas produced from four pounds of sulphur per 1000 cubic feet of air. Sulphur dioxide is particularly efficient in the destroying of parasitic insects. Hydrocyanic acid gas is of especial value for the destruction of rodents, particularly important in the matter of plague.

II. Infection and Resistance

There are certain general considerations common to bacterial infection and resistance which should be considered in connection with the great group of diseases due to bacteria. First should be considered briefly the defense against the invading organisms. The intact mucous membrane or skin is the first line of defense. Absolute immunity is comparatively rare but lesser degrees of immunity are relatively common. One of the most important problems of preventive medicine and its practical application is that of increasing a slight, or producing artificially, a nonexistent natural immunity.

Natural immunity can be subdivided into species immunity as shown in many of the bacterial diseases common in man which can be produced only with difficulty or not at all in animals. Race causes still another variation in immunity. These racial differences are common among human beings. It may be assumed that a race among whom a certain disease has been endemic is less susceptible than are other races among whom it has been recently introduced. Thus tuberculosis among the negroes, measles among the Fiji Islanders, and yellow fever in the white race furnish well-known examples of tremendous damage. This seems to suggest that these endemic diseases have gradually brought about certain degrees of immunity, a hint of inheritance of acquired characteristics.

Of greater importance among humans than almost any other factor is that of varied individual resistance. Thus, no matter how virulent an infection, a certain number of those exposed to it will not be attacked, and there is great variation in the severity of the disease in those who are attacked. This was shown particularly well in the influenza epidemic of 1918. Presumably this can be attributed to individual variations in body physiology or chemistry. Thus, changes in the normal acidity of the gastric secretions may well explain the variation in gastro-intestinal infections.

It has long been noticed that acquired immunity to certain diseases can be obtained through undergoing that disease. One of the most fruitful fields of progress in preventive medicine has been the wider application of these well-established phenomena to the production of artificially acquired immunity, the process of conferring protection by treatment with an attenuated form

or a sublethal quantity of the infectious agent of a disease or its products. In active immunization the individuals immunized gain their power of resistance through the reaction of their body tissues to the substance introduced. Probably our most valuable methods are those of active immunization. Of another order is passive immunity, wherein the protective substance elaborated in the body of one animal is transferred to another. This passive immunization is largely of value against those diseases with powerful soluble exotoxins, such as diphtheria and tetanus. With this sketchy general introduction the various means of prevention practicable against the diverse bacterial infections may be considered.

III. Specific Infections

A. *Staphylococcus*

The first great group of the infectious organisms to be considered is the staphylococcus group, characterized by the production of purulent infections, usually localized. The Staphylococcus pyogenes aureus is the most important of this group. The first and most important method of preventing staphylococcus infections is the rigid maintenance of cleanliness of the skin. The second important element is maintenance of normal body function. Under the first heading should be included the protection of the skin from infected material, particularly when subject to slight trauma as in the case of shaving. One of the most fruitful sources of staphylococcus infections about the face and neck is the barber shop. Many of the furuncles, carbuncles and sycoses can be directly traced to infection in the barber shop. Since the staphylococci are practically universally present in the skin, any abrasion

of the skin is particularly liable to become infected with staphylococci, providing the resistance of the body is in any way depressed, or providing a large number or an unusually virulent strain of organisms gains access. For this reason every care should be taken to keep scrupulously clean every break in the skin, no matter how small, and to be liberal with the use of antiseptic substances in wounds of all types. The use of the common towel and wash basin is also an efficient means of transmitting the organisms.

One particularly important point to be considered is that diabetes mellitus peculiarly predisposes to pyogenic infections, and any case of long-continued, repeated pyogenic infections should arouse suspicion as to the existence of diabetes or at least high blood sugar.[5]

One of the most troublesome of the skin infections is paronychia, which may be prevented, ordinarily, by care of hangnails and ingrowing nails. Among the most dangerous of the boils are those about the nose and lips, which not infrequently, particularly in the case of the upper lip, progress rapidly and cause fatal septicemia.

The means of prevention of staphylococcus infections may be summed up as follows: cleanliness; avoidance of contact, direct or indirect, with the infected skin of others; and the avoidance or correction as far as possible of abnormal metabolic conditions. Active immunization with autogenous vaccine in cases of individuals suffering from staphylococcus infections is apparently of definite value, particularly in subacute or chronic cases, and those in which there are repeated infections. Passive immunization is of negligible value.

[5] Joslin, E. P. The Treatment of Diabetes Mellitus (4th ed.). Philadelphia, 1928.

B. *Streptococcus*

One of the most important of the pathogenic organisms is the streptococcus. There are many Gram-positive cocci forming chains, and the subdivisions of this group are practically endless. However, the pathogenic group of streptococci may be divided into three main groups: the hemolytic streptococci; the streptococcus viridans group; and the nonhemolytic streptococci.

Streptococci, as well as staphylococci, are of great importance in the infection of wounds. The streptococci die out fairly rapidly under ordinary conditions, although in sputum or excreta they may remain alive for several weeks. The two great groups, the Streptococcus hemolyticus and the Streptococcus viridans may be considered separately as they vary considerably in their behavior.

1. The Streptococcus hemolyticus group is associated particularly with four disease entities: (1) streptococcus infection with septicemia; (2) scarlet fever; (3) erysipelas; (4) puerperal sepsis. There are probably more fluctuations in the virulence and pathogenicity of streptococcus than in almost any other of the bacterial races. Superficial cutaneous infections are frequently caused by streptococci. Occasionally these lesions may be localized but usually go on rapidly with slight edema, lymphangitis, and severe systemic manifestations, often with a rapidly progressive cellulitis. The importance of stemming the infection before it passes the regional lymph nodes is obvious, as once it passes the regional lymph nodes it enters the blood stream, and the outlook in streptococcus septicemia is extremely poor. In spite of the great virulence of streptococcus once it has gained

entry into the body, it has but little penetrating power and requires, as a rule, a port of entry prepared for it. Therefore, the prompt disinfection of all cuts and wounds is of particular importance.

There are numerous antiseptic agents available, ranging from such simple substances as tincture of iodine to the far more complicated but apparently equally efficient mercurochrome and other preparations.

Wound infection with streptococci is particularly dangerous as the tendency of the organisms to gain entrance into the blood and lymph stream and multiply actively there is strong.

Erysipelas is a skin infection produced by Streptococcus hemolyticus. This occurs usually in senile or alcoholic individuals, or those debilitated by long illness. Streptococcus infection of the face is very apt to start about the labial folds and is probably associated with the plucking of hairs from the nose or the picking of the nose. Another of the very dangerous infections caused by streptococci is puerperal sepsis, but with the more modern obstetrical methods this infection is fortunately becoming increasingly rare. Rigid surgical cleanliness and the avoidance of unnecessary vaginal examinations are the most important items in the prevention of this disease. The sterilization of bedpans should not be overlooked.

Another important streptococcus infection is follicular tonsillitis. Tonsillectomy is a means of preventing repeated attacks of follicular tonsillitis, although frequently tonsillectomy is not thought of until after the infection has taken place.

There was one striking epidemic of septic sore throat due to streptococci in Boston in 1912. The Lee epidemic

of 1928 is still fresh in our minds. The first of these sore throat epidemics was observed in England in 1875. Septic sore throat is practically always due to milk infection and may be completely prevented by the use of pasteurized milk. In the Boston epidemic in 1912 high-grade milk produced under very careful conditions was incriminated. If this milk had been pasteurized the epidemic would not have taken place.

Scarlet fever is such an important disease that it deserves treatment in a separate section and will be taken up subsequently.

Streptococcus infections of the lungs are frequently secondary to such diseases as measles and influenza, and presumably these two conditions as well as certain other mild diseases of the respiratory tract render the individuals susceptible to a very unusual degree to streptococcal bronchopneumonia. It is important in the prevention of this condition to avoid, so far as possible, overcrowding of individuals, and to guard particularly against the transmission of the disease by those suffering with it.

2. Most important among the infections caused by the Streptococcus viridans group is subacute vegetative endocarditis. In this disease there is evidently an association between focal infection (such as in teeth or tonsils), with Streptococcus viridans, and subsequent infection of the endocardium. However, it is very difficult to tell where to draw the line in the extirpation of supposedly or definitely established septic foci. The whole problem of so-called focal infections [6] is intimately related with that of the Streptococcus viridans group. It is difficult to lay down any general rules, except to

[6] Billings, F. *Arch. Int. Med.* 9: 484, 1912.

say that as far as prophylactic measures are concerned it is advisable to clear up any readily accessible and obviously infected foci. How far the X-ray pictures of the so-called alveolar abscesses may be trusted is extremely problematical. Curiously enough, in streptococcus infections there is no marked degree of immunity produced by one attack. Active immunization is of little if any avail except in the scarlet fever group. Passive immunization in experimental animals is of quite definite value. However, passive immunization has yet to give any reliable results in humans.

3. It has been known for many years that streptococci are definitely associated with scarlet fever and that scarlet fever usually starts with a sore throat which has many points of similarity with that of septic sore throat. When positive blood cultures were found in scarlet fever the organisms proved to be hemolytic streptococci. Gabritschewsky [7] attempted to make a vaccine of broth plus streptococcus organisms. When this vaccine was used for a prophylactic vaccine for children it resulted in general systemic and local scarlatiniform rashes. Dick and Dick [8] definitely proved the etiological relationship of streptococci and scarlet fever. Through the Dick skin test we have a fairly useful and accurate means of determining, by injection of scarlet fever toxin, the degree of susceptibility of given individuals to scarlet fever. Zingher [9] has done a considerable amount of work on this point and has shown that it holds true in most cases. Once a method has been developed for determining the susceptibility of an

[7] Gabritschewsky, G. *Berl. klin. Wchnschr.* **44**: 556, 1907.
[8] Dick, G. F., and Dick, G. H. *Jour. Am. Med. Assoc.* **81**: 1166, 1923.
[9] Zingher, A. *Ibid.*, **83**: 432, 1924.

individual to scarlet fever, the next and most obvious point to consider is whether susceptible individuals may be immunized either passively or actively. Passive immunization has been known for a considerable period of time and was first attempted in 1903 by Moser.[10] The serum was apparently encouraging but fell into disuse. It was not until recently that the problem was re-investigated. Scarlet fever human convalescent serum and normal human serum were found to be of some value, and favorable results have been obtained. The next step was active immunization, and through the Dick toxin apparently definite advances have been made. The disease is transmitted by secretions from the nose and throat, and all stages of the disease presumably are communicable. Contagion is at its height during the earlier stages, where the anginal symptoms are much more marked than the rash, and frequently the diagnosis has not been made. The period of contagion may persist for a considerable length of time.

In addition to direct infection both from localized cases, missed cases, and possible carriers, there is definite evidence of transmission by milk. Trask [11] has collected data on thirty-five scarlet fever epidemics traceable to milk. The milk-borne epidemics of course may be wiped out by pasteurization. So far as the prevention of the disease due to human contact is concerned, attention must be devoted to early recognition and rigorous quarantine of cases of the disease. It is not enough in scarlet fever epidemics to isolate those cases developing rashes, but in addition those which develop a sore

[10] Moser. *Wien. klin. Wchnschr.* **15**: 1053, 1902.
[11] Trask, J. W. *U. S. Hyg. Bull. No. 41.*

throat, however slight, must be regarded as suspicious until the lesion is proved to be not scarlet fever. Through active immunization by the Dick toxin and through passive immunization we have a possibility of prophylactic vaccination. This is developing rapidly and it is to be hoped that ultimately it will be as satisfactory as immunization against diphtheria.

C. *Pneumococcus*

1. The vast majority of cases of lobar penumonia are due to the Diplococcus pneumoniae. In the series of Avery,[12] 454 out of 529 cases were due to Diplococcus pneumoniae. The studies of Neufeld and Haendel [13] show that the pneumococcus may be divided into three specific types, and a number of different related organisms which may be classified as a fourth type. Apparently the types vary in different parts of the world. Lister has found three types in South Africa, two of which correspond with the American types; one is totally different. This matter of the different types of pneumococci has obviously important epidemiological bearing.

One important consideration is the viability of pneumococcus in sputum. Ottolenghi [14] showed that pneumococci could live in sputum from one to four months if protected from light, and could live for nineteen days when in diffused light. Wood [15] found that the pneumococci under ordinary conditions would survive only

[12] Avery, O., Chickering, H. T., Cole, R., and Dochez, A. R. *Monogr. Rockefeller Inst. No. 7.* 1917.

[13] Neufeld, F., and Haendel. *Arb. a. d. k. Gsndhtsamte.* **34**: 293, 1910.

[14] Ottolenghi, D. *Centralbl. f. Bakt.* **25**: 120, 1899.

[15] Wood, F. C. *Jour. Exp. Med.* **7**: 592, 1905.

about one and one-half hours in fomites. They are killed by strong sunlight in an hour. Low temperatures favor preservation of life and virulence. Fortunately the pneumococcus is very susceptible to germicidal agents of all types. In sputum the surrounding material appears to be a barrier to antiseptics and 20 per cent alcohol appears to be the most effective.

It has been shown with particular effect by Felton [16] that the virulence is enormously increased by rapid transfer, and the bearing of this upon the transmission of disease from one person to another is obvious. The route by which the pneumococcus reaches the lungs has not yet been definitely settled. There is a good deal of evidence that a direct infection by the air passages is the most important method. So far as protection of individuals has been concerned there have been a number of attempts to produce a serum for passive immunization. However, none of these methods has as yet been satisfactory.

In considering the epidemiology of the pneumonias they must be divided between the primary and the secondary types. It is likely that there are carriers of virulent pneumococci. Those associated with pneumonia patients frequently show the same type of organisms in their mouths as are causing the disease in the patient. Pneumonia must be considered as a contagious disease, but it is one in which the susceptibility factor is of enormous importance. Pneumonia epidemics practically never occur in well-nourished and well-housed communities. Practically all epidemics which have been studied have shown that the susceptibility factor was the determining one. In other words, the

[16] Felton, L. D., and Dougherty, K. M. *Jour. Exp. Med.* 39: 137, 1924.

best means of prevention of lobar pneumonia is maintenance of the best possible hygienic condition of the individual. However, it is well to maintain our opinion of lobar pneumonia as an infectious disease, to make it reportable, and to make every effort and take every precaution to prevent the transmission of sputum, including the careful disposal of sputum and disinfection of the mouth for some weeks after recovery from the disease.

Secondary or bronchial pneumonia presents a totally different problem. The influenza epidemic of 1918 is an excellent example of a highly contagious disease in which frequent infections with secondary pneumonia occurred. As a matter of fact, according to the Surgeon-General's report for 1918, 82 per cent of all the deaths in the Army were due to acute respiratory disease. The studies made during the war showed that immediately putting the patient to bed as soon as infection is suspected is of utmost value in preventing the development of secondary infection. It is advisable to provide infected patients with a mouth wash and have the attending doctors and nurses wear gauze masks in order to protect the patients from any pneumococci and streptococci present. In addition, every precaution should be taken to prevent the transmission of organisms from bed to bed. Thus, in this type of disease the effort to prevent the disease lies almost entirely in preventing transmission. Prophylactic vaccination against pneumonia has been extremely unsatisfactory. The best work so far has been that of Lister in South Africa, who has had varying results with subcutaneous inoculation of two to three billion organisms. Cecil and Austin vaccinated 12,519 men at Camp Upton against the three specific types, but their results were uncertain. The

prophylactic value of pneumonia vaccination is far from proved. However, it does no harm other than in those acutely sick, in tuberculosis, nephritis, heart disease, and pregnancy.

D. *Influenza*

Influenza is above all an epidemic disease. Its etiology is still unknown, although more and more evidence seems to incriminate Pfeiffer's bacillus. Some attention has been paid to the filtrable virus but no definite evidence has been produced. The Bacillus pneumosintes of Olitzky and Gates has been blamed, but no conclusions can be drawn at the present time. There are many mild cases of the disease, so it is very difficult to establish a diagnosis and to determine its actual prevalence. The 1918 epidemic appeared in China, and the western front in 1917, and finally in September and October, 1918, swept over the world.

E. *Whooping Cough*

Whooping cough is due to the Bordet-Gengou bacillus. Prophylactic vaccination using this organism has been attempted on a large scale. The experiments of Davies [17] are definitely encouraging. However, the value is not completely established. The use of convalescent serum apparently protects contacts. The prevention of whooping-cough is particularly important owing not only to the disease itself, but to the pulmonary complications that follow it. It is most dangerous for young children, 90 per cent of the deaths from whooping cough occurring in those under three years of age. The disease has definite epidemic tendencies and is very apt to become epidemic coincidentally with measles.

[17] Davies, G. R. *Am. Jour. Dis. Child.* **23**: 423, 1922.

F. *Cerebrospinal Meningitis*

Cerebrospinal meningitis is ordinarily a primary infection. Secondary infection of the meninges may occur in the course of pneumonia or general sepsis, from extension of suppurative lesions about the skull, such as otitis media or mastoiditis, or from compound fractures. According to Weichselbaum,[18] 69.2 per cent of the cases are due to the meningococcus, 20.8 per cent to the pneumococcus, and the remainder to other organisms. When the disease occurs in epidemic form practically all cases are due to the meningococcus. Gordon found that the various organisms could be divided into four distinct types. In America, Flexner [19] and others have found that there are two main types. The differentiation of these two types is obviously important, since any serum used for treatment must correspond to the specific type of organism present, or else polyvalent serum must be used. From the point of view of practicability, a polyvalent serum is the most valuable, since no time is wasted in determining the type of organism present. The difference between recovery and death often depends on the speed with which a diagnosis is made and proper treatment given.

One important diagnostic point brought out by Zinsser is that the organisms autolyze rapidly in the spinal fluid, and it may occasionally be very difficult to find the organisms. In such cases it is safe to regard fluid from a case of acute meningitis in which the polymorphonuclear leukocytes predominate and no organisms are seen as probably due to the meningococcus. The pre-

[18] Weichselbaum, A. Article in Kolle und Wassermann Handbuch.
[19] Flexner, S. *Bull. Rockefeller Inst.*, 1917.

vention of cerebrospinal meningitis is closely linked with that of the upper respiratory tract infections. The highest case rates occur in cold and wet weather, when there are favorable conditions for the lodgment of organisms and for the general distribution of infected material by coughing, sneezing, and spitting. Fortunately, the meningococci do not survive easily outside the body and rapidly die out in dust, or even in sputum under conditions of low temperature or dryness. The meningococci may be present for a long time after convalescence, and they are also present in about 2 per cent of healthy individuals. Transmission presumably occurs from the nasopharynx of one individual to that of another, presumably by close contact with carrier or case.

The carrier in this disease, as in many others, is the chief problem. In view of the wide distribution of the disease, there must be a peculiar difference in susceptibility among the general population which cannot be traced to any determinable cause, since those in perfect health may be attacked as well as those who are feeble. At present, extensive carrier examination and the isolation of carriers is probably of little avail, and the best preventive measure is to make every effort to cut down the incidence of respiratory disease, and to reduce the carrier examinations to the intimate group from which the case has come. In making bacteriological examinations the technique is of great importance, and the West tube method is probably the best, with the swabs streaked on glucose hormone agar with defibrinated blood added.

G. *Gonococcus*

Infections due to the gonococcus are probably the most prevalent of the venereal diseases. The report of the Surgeon-General of the Army, 1919, indicates that 5.6 per cent of the drafted men were infected with venereal disease. Gonorrhea is about four times as common as is syphilis. Particularly important from the standpoint of prevention is the difficulty of complete cure. The organisms may remain viable and capable of infecting others for a great many years, even though the individual harboring them is practically symptom-free. The gonococcus is very short-lived outside the body.

One of the most striking examples of the efficacy of preventive medicine has been developed in connection with gonorrheal infection, through the introduction of Credé's method of instilling 2 per cent silver nitrate solution into the conjunctival sacs of every child at birth. Other silver solutions are also being used at the present time. The protection afforded by this method is so great and the effects of ophthalmia neonatorum so disastrous that it is inexcusable to omit this procedure, no matter to what class of society the child may belong.

Another gonorrheal infection of marked importance in children is vulvovaginitis. This generally appears in the children's wards of hospitals or in orphanages. Epidemics once established are extremely difficult to arrest and the consequences for the children may be extremely grave. It is best to delay the admission of female children to the general wards until vaginal examinations have been made for gonococci. The closest care should be given to sterilization and disinfection of all material from persons coming in contact with the case.

The past few years have seen a great change in the attitude of the public toward venereal disease. This was particularly marked during the period of the war. From the standpoint of physicians and epidemiologists, the most pressing consideration is that of the prevention of infection rather than the promulgation of theories of morality.

Considered from the sanitary aspect there are three important angles:

1. Accurate diagnosis should be promoted through education of the public in the seriousness of these infections and an attraction of the patient away from quacks to reliable clinics and physicians. As a corollary, diagnostic clinics should be established by departments of health. The clinical facilities in our larger hospitals should be fully developed.

2. Venereal diseases are communicable and, as such, subject to report. There are many reasons why various systems of reporting meet with objections and are unsatisfactory. They are, however, necessary. The Massachusetts system of reporting by numbers is apparently the best. The ideal way would be to follow Zinsser's suggestion of having the record destroyed whenever the reported individual can bring a certificate of cure from a responsible physician.

3. Hospitalization is of great importance for the prevention of spread of infection. However, patients are often not greatly incapacitated and it is extremely difficult to keep them under control. Compulsory hospitalization probably will never be practical, but certainly those cases which do not coöperate in maintaining treatment should be hospitalized.

Individual prophylaxis against gonorrhea is as yet

uncertain. The statistics of the United States Army and Navy indicate that it is of value, but as yet it is impossible to judge accurately.

H. *Diphtheria*

Probably the disease in which preventive medicine has made the most outstanding advance is diphtheria. We have satisfactory means of determining by the Schick test those susceptible and those immune; of either passively or actively immunizing those who need protection; and we have a specific curative measure. Unfortunately, the bacillus has good powers of resistance to light, dryness, and low temperatures, so that unless some definite chemical means of disinfection is employed it may survive for some time.

One complicating factor is that there are many diphtheria-like bacilli which are not toxin producers. While in the presence of clinical diphtheria it is ordinarily regarded as sufficient to find the characteristic bacilli, in other cases where there is no evidence of clinical diphtheria, and particularly in the case of carriers, it is essential to determine whether they are avirulent or virulent bacilli. Owing to the formation of a diffusible toxin by the bacteria, it is essential that the presence of the toxin in the body be counteracted by the use of antitoxin to save life or to avoid the long train of complications which are apt to follow, such as peripheral neuritis and myocardial degeneration.

In connection with the prevention of the disease itself the special articles which appear annually in the *Journal of the American Medical Association* [20] should be consulted. The problem of diphtheria carriers is a par-

[20] Diphtheria Mortality. *Jour. Am. Med. Assoc.*, **90**: 1621, 1928.

ticularly serious one, since about 1 per cent of the population in the cities appear to have a bacillus identical morphologically with the diphtheria bacillus. Only a small proportion of the organisms isolated from carriers, however, are virulent.

With these facts in mind it is relatively easy to outline a practical procedure for the prevention of diphtheria:

1. Isolation of cases.
2. Precautions against the transmission of infected material from one individual to another.
3. Schick tests made on the entire group with active prophylactic immunization for all those with positive Schick tests.
4. Cultures taken from those associated with cases and carriers controlled.

I. *Tuberculosis*

In tuberculosis, preventive medicine has made more headway than in many other of the infectious diseases. There is a good deal of discussion as to the mode of entrance of the tubercle bacilli into the body.[21] Pulmonary infection may be due either to direct inhalation or to spread through the lymphatics. Probably the tonsils are an important port of entry for lymphatic spread. Moreover, direct infection of the mucous membrane of the intestinal tract may take place and thence the bacilli may gain entrance to the lymphatics. Calmette feels that in the majority of cases the mucous membranes of the mouth, pharynx, and intestines are the chief portals of entry. Opie[22] feels that the primary

[21] Calmette, A. L'Infection bacillaire de la tuberculose. Paris, 1920.
[22] Opie, E. L., and Andersen, H. *Am. Rev. Tub.* 4: 629, 1920.

infection may occur either by way of the lungs or the gastro-intestinal tract. There is little doubt that inhalation is the most common means of human infection at present. Fomites are particularly dangerous. In addition, the bacilli remain living for a long period of time, particularly in dust, and are comparatively resistant to drying and sunlight.

Infection may also take place through direct contamination of food from the sputum or saliva or indirect contamination by fingers or flies. Milk requires special precautions, and presents bovine in addition to human tuberculosis. It is extremely important that all milk be pasteurized and that any raw milk be certified and come from tuberculosis-free herds.

In no disease is prevention more closely related to sociological and economic problems than in tuberculosis. Tuberculosis increases directly as does poverty. Industrial tuberculosis is of great importance in relation to ventilation, to dust, and to general conditions. It is hardly possible in a brief outline to discuss thoroughly the means of prevention of tuberculosis. However, the following points can be emphasized: education of the public in the danger of tuberculosis; the diagnosis of early cases; the control of infected individuals by compulsory notification; care and disinfection of expectorations; isolation so far as practical; and the control of dust and dirt. In this last connection the vacuum cleaner is of striking value in that it removes dirt without stirring up dust. It is extremely important to improve housing conditions; to provide open spaces, particularly playgrounds and parks; to provide education in hygiene; and to maintain proper sanitary conditions in shops and factories. In addition, it is necessary

to teach the public that tuberculosis is curable and to train physicians to recognize it in its earliest stages when it can still be cured.

Undernutrition can and should be absolutely prevented so far as school children at least are concerned, by furnishing adequate lunches in the schools to supplement the meals in the home.

In the prevention of no disease is the medical side of the problem so small relatively as it is in the case of tuberculosis. But the stimulus must always come from the medical profession.

J. *Bacillus Typhosus*

While the advances of modern sanitation have greatly reduced the prevalence of typhoid fever, it is still an important factor in increasing mortality and morbidity rates. From the standpoint of protection of the individual the most important prophylactic measure is inoculation with the dead organisms. The practicability of this measure was first demonstrated by Pfeiffer and Kolle,[23] and later by Pfeiffer and Marx. At present the Rawlins strain of organism is generally used for preparing the vaccine. The value of antityphoid inoculation is strikingly brought out in the Surgeon-General's report published in 1919. In spite of the great crowding of men in the camps, and the appalling conditions, the typhoid rate was forty-five times lower in the Army than in civilian life during the same period.

However, inoculation is not a complete protection, as a large dose of virulent organisms may occasionally be sufficient to overcome resistance. Under ordinary

[23] Pfeiffer, R., and Kolle, W. *Deutsch. med. Wchnschr.* **22**: 735, 1896.

conditions vaccination will protect from two to three years. The vaccine as used at present consists of a mixture of Bacillus typhosus and of Bacillus paratyphosus A and Bacillus paratyphosus B. Three doses are given at intervals from seven to ten days.

The typhoid bacillus is very resistant to cold so long as moisture is supplied. It will live for months in water or ice. Milk is an ideal medium for its growth. Infection with typhoid fever invariably means that the excretions from a case or carrier have contaminated something ingested by the patient. While the great epidemics of typhoid fever of thirty or forty years ago have been practically eradicated by proper safeguarding of water supplies and proper disposal of sewage, we are not yet entirely safe, as is illustrated by the recent Montreal milk epidemic.

In the patient with typhoid fever, bacilli begin to appear in the intestinal discharges during the later stages of the incubation period. They reach their maximum about the end of the second week and usually disappear by the end of convalescence. However, they sometimes remain in the excretions for months or years. In about one-third of the cases, organisms appear in the urine also during the second or third week. Fortunately, the recognized case of typhoid fever is usually well guarded from a sanitary standpoint. Isolation and disinfection of feces and urine are usually efficiently carried out. One dangerous source of typhoid infection at the present time lies in the mild atypical case, which is frequently unrecognized.

The carrier problem is of great importance. Carriers may be roughly divided into a temporary class and a chronic class. Temporary carriers usually become free

of bacilli within three months after convalescence, while the chronic carriers harbor bacilli for many years and perhaps permanently. Gay estimated that about 5 per cent of the cases of typhoid fever remain carriers. This would mean that about 7,500 new carriers are added annually, to those present in the United States.

By far the most common localization of typhoid bacilli in the carrier is in the gall bladder and possibly in the intrahepatic ducts as well. Some carriers harbor organisms in chronic intestinal ulcerations or chronic appendiceal lesions. A few cases have been found with pathological lesions in the urinary tract where the bacilli appear in the urine. It is easy to see that as sanitary measures reduce the wholesale method of distributing the bacilli in water, milk, and food, the carrier problem will vastly increase in importance. In not a few cases removal of the gall bladder has remedied the condition.

K. *Bacillary Dysentery*

Bacillary dysentery may be conveyed by a number of different agencies. Probably direct transmission of infected material from one individual to another and the indirect contamination of food are most important. The organisms may frequently remain viable a considerable period of time in water so that in rural districts or under camp conditions contamination of water supplies and the scattering of infected material by flies take place very readily.

The carrier problem is as important as it is in the case of typhoid fever, and much harder to control because of the difficulty of isolating small numbers of organisms from the stool. Preventive measures must be dependent chiefly on the proper disposal of feces, including their

disinfection, the fly-proofing of latrines and kitchens, the early isolation of suspicious cases, and the careful inspection of food handlers as to health and cleanliness.

L. *Tetanus*

Though tetanus bacilli are widely distributed in nature the infection is comparatively infrequent. Deeply lacerated wounds, particularly those in which foreign bodies or other microörganisms are present, are particularly favorable for their development. The infection with tetanus is peculiar in that the organisms remain local and the damage is done by their soluble toxin, which has a specific affinity for nerve tissue.

Fortunately we have an antitoxin available for tetanus which is extremely valuable as a prophylactic. Its value was demonstrated[24] strikingly during the War when many wounds were infected with tetanus bacilli, but where the incidence of tetanus was greatly reduced once the prophylactic antitoxin was made use of. In addition, there should be early excision of the wound area and a thorough cleaning up of all loose or necrotic tissue. Unfortunately, once the neurological symptoms have appeared, serological treatment is practically of no avail.

As a general rule, the tetanus bacillus gives little indication of its presence until the fully developed symptoms of the disease have appeared. Symbiosis with other organisms in wounds is very favorable for its development. There is no justification for neglecting to treat any puncture, marked laceration, or dirty wound as one probably infected with tetanus, and the prophylactic injection is absolutely essential.

[24] Tulloch, W. J. *Jour. Hyg.* **18**: 103, 1919.

M. *Bacillus Botulinus*

The means of prevention of botulism is extremely simple. Thorough cooking of foods destroys the botulinus toxin. If canned goods were brought to a boil before eating there would be no danger, as any toxin which might be present would be destroyed. However, prevention should begin further back, and those who can food, whether in the factory or in the home, should realize the possibility of contamination and know that the spores of the bacillus botulinus may be present on fruit or vegetables. It is particularly important to realize that infection may take place without there being any apparent change or even odor in the food. A safe rule is never to eat any canned goods unless they have been thoroughly cooked beforehand.

N. *Bacillus Pestis*

Bubonic plague is due to the Bacillus pestis. It is acquired by man in two ways. The first and most important is by entrance of the bacilli through the skin as the result of the bite of an infected flea. During the act of biting, the flea may either regurgitate infected blood or more commonly deposit infected feces on the skin. In this case the infection may very rapidly be rubbed in the skin by the clothing or by scratching the flea bite.

The rarer method is direct inspiration of infected sputum in the pneumonic form of the disease. Ordinarily about 2.5 per cent of the cases occurring during the epidemics of bubonic plague are of the pneumonic form.[25] Occasionally there are great epidemics of the

[25] Castellani, A., and Chalmers, A. J. Manual of Tropical Medicine (3d ed.). New York, 1919.

pneumonic form of the disease, such as that in Manchuria. The prevalence of the disease in ancient times was very striking. Through the Middle Ages many epidemics swept over Europe, usually from the Orient. For one hundred years it has been endemic in India and epidemic in China. The disease is a constant menace in many different parts of the world. Even the United States is not free. Foci have appeared in California, in Texas, and in New Orleans. The conditions of climate in many parts of the United States are by no means unfavorable for the appearance of plague in epidemic form. The spread of plague by rats has been known for many years, and in fact suspected even in ancient times. According to the British Plague Commission rats are usually infected by means of fleas, and it is by this same insect that the disease is carried to man. The survival of the plague flea away from its host depends very largely on the ratio between temperature and moisture. The climate, therefore, plays an important part in plague transmission by determining the length of time that a flea may live while changing from the rodent to the human host.

Plague prevention, therefore, is primarily a matter of rat extermination and protection against fleas. The killing of ships' rats when vessels arrive from foreign countries, provision against the escape of rats from ship to shore by way of hawsers, and the like are very important. Strict quarantine regulations are essential. It is doubtful if the seven-day quarantine required by the United States of ships coming from plague ports is long enough.

Once foci of plague are discovered, rat extermination and isolation of the immediate region are important.

In primitive villages actual burning of the houses is sometimes resorted to, but this is apt merely to scatter the rat population. The careful isolation of human cases is of course necessary.

The Haffkine vaccine has been used in India on a very large scale.[26] In isolated epidemics its worth has been strikingly shown. Unfortunately, it is not a complete protective measure, and it is to be hoped that some further means of specific protection may be developed.

O. *Spirocheta Pallida*

Spirocheta pallida, the etiological agent of syphilis first described by Schaudinn in 1905, is of great importance from the standpoint of bacteriology. One of the most important functions of the bacteriological laboratory is the establishment of diagnosis of syphilis through detection of spirochetes in primary lesions. The spirochete is not resistant to unfavorable environment and dies rapidly if not kept moist. Immunization in syphilis has been often attempted but is not satisfactory although clinical observation has shown that during active syphilis the patient cannot be superinfected. All attempts at passive immunization have been unsuccessful. From the standpoint of prevention of syphilis the most important factors are avoidance of exposure and the prevention of marriage of syphilitic individuals. The various prophylactic measures proposed will be discussed under the section on syphilology.

P. *Smallpox*

Filtrable viruses, little known as they are, provide us with one of the most striking examples of preventive

[26] Haffkine, W. M. *Ind. Med. Gaz.* **33**:7, 1897.

medicine, vaccination against smallpox. Smallpox is one of the most virulent of the infectious diseases. While the etiological factor is still unknown, its specific bodies have been observed in the epithelial cells of smallpox lesions. Early attempts were made to protect against this disease through exposing healthy individuals during mild epidemics. However, the investigations of Jenner in 1798 proved that cowpox protected against smallpox. This method is that in use today. Great care is necessary in the production of vaccine. In order to rule out any possibility of transmission of syphilitic infection vaccine is collected from calves. Vaccination of humans at present is performed by the multiple puncture method.[27] Vaccinated individuals should be cautioned not to scratch and should be instructed to keep the lesion clean. No shield of any type should be used as occasionally severe infections and even fatalities have developed subsequent to the use of shields of one type or another.

Q. *Rabies*

Another of the filtrable viruses is that of rabies. It was estimated by Cornwall that of individuals bitten by rabid dogs and untreated 35 per cent died. The danger of the bite depends to a large extent on the amount of saliva that comes in contact with the wound. The poison virus is conveyed to the central nervous system chiefly by the path of the nerve trunks, therefore the incubation period is shortest and the disease most severe in wounds about the head and neck. Fortunately, the incubation period is long enough to permit of prophylactic immunization after the bite has been received.

[27] Rosenau, M. J. Preventive Medicine and Hygiene. New York, 1927.

The diagnosis may be based on the presence of Negri bodies in the pyramidal cells of the hippocampus and in the Purkinje cells of the cerebellum. The Pasteur treatment, the subcutaneous injection of attenuated virus prepared from emulsified, dried cords of infected rabbits, is extremely efficient in preventing the disease. A number of preparations are in use, although the prevailing one in this country is that of Semple, with some modification. The problem of the control of rabies lies largely in the control of the stray dog, which is the great carrier of the disease in civilized communities. The prophylactic immunization of dogs is still in the experimental stage, although it is quite satisfactory. Through rigid quarantine and strict enforcement of license requirements, even aside from immunization of dogs, it would be possible to reduce greatly the incidence of this disease. The relationship with dogs has been so constantly fixed in the mind of the public that bites from other animals are not considered as serious as they should be. Two deaths from bites by rabid cats have recently occurred in Boston.

R. *Measles*

Probably the most prevalent of the serious contagious diseases is measles. The etiology is still unknown. Crum [28] has shown that measles is responsible for about 1 per cent of all deaths in the temperate zones. The most dangerous period for measles is the first two years of life, due to the great tendency to develop secondary respiratory infections. It is safe to assume that the exposure to measles of an uninfected human being will result in an attack. The secretions of the nose and

[28] Crum, F. S. *Am. Jour. Pub. Health*, 4:289, 1914.

throat are presumably the means of transmission of infection, and very important from the epidemiological standpoint is the infectiousness of the secretion even before a rash has appeared. In large groups the most satisfactory way of controlling measles is constant inspection and early segregation of all those showing evidence of catarrhal colds. Passive immunization and convalescent serum are of some value in the prevention of the appearance of the disease in exposed individuals. However, the immunization conveyed is short-lived and the method is of necessity applicable to only a small number of cases.

S. *Acute Poliomyelitis and Encephalitis Lethargica*

These two diseases are closely related. Their etiology and the means of transmission of infection is unknown, although the disease may be transmitted to monkeys by inoculation of spinal fluid, brain or cord. The virus is filtrable and as yet no formed element has been found constantly present in infectious material. The work of Flexner [29] and of others has shown that the virus may leave the body with secretions from nose and throat and intestines. Apparently the virus can survive for some time outside the body. There is some evidence to show that poliomyelitis carriers exist. The use of convalescent serum for treatment of early cases is apparently fairly hopeful, but as yet we have no satisfactory means of prevention of the disease.

In encephalitis lethargica practically no headway has been made so far as prevention of the disease is concerned.

[29] Flexner, S., Clark, P. F., and Dochez, A. R. *Jour. Am. Med. Assoc.* 59:273, 1912.

V

PARASITOLOGY

Any adequate course in parasitology makes obvious to the student measures for the prevention of the parasitic diseases, and to the student trained to think for himself emphasis on this feature is perhaps superflous. However, since much of the time must necessarily be devoted to what may be termed medical zoölogy rather than to the explicit correlation of the parasite with the disease in humans, it is not amiss to emphasize certain points of practical importance in the prevention of the parasitic disease.

While the accuracy and thoroughness with which any such material is presented depends on the knowledge and experience of the instructor as well as the time allotted for the particular type of instruction, it is possible in any course to outline, briefly at least, the more important points of value from the point of view of prevention. In order to give the maximum amount of correlation it is perhaps as well to consider the various preventive measures in connection with the various types of diseases.

I. Hematozoal Diseases

There are certain general prophylactic measures which can be applied to the entire group of diseases affected by the protozoan parasites of the blood. The first and most obvious method is the reduction of the number of those blood-sucking arthropods which act as intermediate hosts for the various parasites.

Anti-mosquito measures are widely known and widely applied, and are aimed chiefly at the destruction of the larvae before they have an opportunity to develop. Especially valuable against Stegomyia and Culex fatigans is the prevention of the accumulation of standing water in or about houses, such as in old tin cans, cisterns, or barrels. Where the malarial mosquito is concerned the attack must be carried farther from habitations, through the drainage of pools and ponds wherever this is practicable, or the covering of the surface of the water with oil or Paris green, or the stocking of the water with top minnows. In addition, the clearing of thick brush or swampy woodland is also essential.

So far as flies are concerned, efforts at control can best be made through careful screening or covering of garbage, proper protection and distribution of manure, and sanitary control of dumps. Fly traps are somewhat valuable as a local measure, but relatively unimportant in any large program.

During the last war the problem of louse control was thoroughly worked out and we have now adequate methods available for eradication of this type of vermin. Simple cleanliness is the first and most important measure, and this can be supplemented whenever necessary through the large-scale use of delousing plants, where the individual is freed from the vermin at the same time that his clothes are sterilized. The second group of measures is those dealing with the means of protection from insects which may or may not be infected with the various parasites. There are a number of simple measures which are extremely valuable from the practical standpoint, such as the construction of houses in high, breezy locations, keeping trees and shrubbery at a

distance from the house, careful screening, the use of electric fans, and the use of the various types of mosquito repellants by individuals much out of doors. In addition to the protection of healthy individuals, it is even more important to protect those sick with the hematozoal diseases from the bites of insects. The patients should be kept in mosquito-proof buildings, and fumigation should be employed frequently to destroy any insects that may have gained access to the buildings.

Almost as important as the protection of the sick is the need for detecting and treating chronic carriers of these diseases. No matter how numerous insects of a species capable of transmitting a given disease may be, they are harmless until they have been infected by biting either a case or a carrier of that disease. Owing to the length of time during which the carriers are capable of infecting insects, and owing to the increased exposure of carriers to insect bites through outdoor activities, the problem of carrier control is more difficult than that of control and protection of acute cases of the disease. At times, particularly in malarial regions of little civilized communities where the problem of insect control, as well as the control of infected individuals, is extremely difficult, general prophylactic measures may be resorted to, all exposed individuals being treated. Malaria is practically the only disease where this method is important or advisable, but in malarial regions it is well to give every member of the community a prophylactic dose of quinine.

In taking up the life cycles of various parasites, it is relatively easy to lay stress on the fact that after the chain is broken at any point propagation of the parasite

is no longer possible, so that by combining different methods of attack with different stages in the life cycle of the parasite it should be possible to gain complete mastery of it. While these points should be obvious to the intelligent student, it is perhaps worth while to emphasize them in order that he may more clearly realize the possibilities offered by preventive measures in diseases of this type.

II. Enteric Diseases

There are certain parasitic diseases in which the mouth is the avenue of infection. The two most important groups of these are amebiasis and helminthiasis.

A. *Amebiasis*

Amebiasis is of importance in subtropical as well as tropical countries. The infection is transmitted by the ingestion of material contaminated with infected feces. Fly control is particularly important as a preventive measure, as the flies[1] not only can transmit amebiasis by carrying infected material, but they also ingest infected material and the amebae pass through their intestinal tract unaltered, so that fly drops may be as potent a source of danger as is the original fecal material. In tropical regions the only safe rule is to use boiled or otherwise disinfected water, and to eat only cooked foods and vegetables. In addition to this, various methods for fly control are absolutely essential. The practice of using night soil as fertilizer in many of the tropical and oriental countries provides an ample supply of infectious material on vegetables. Obviously

[1] Buxton, P. A. *Brit. Med. Jour.* 1:142, 1920.

the three important methods of attack here are: (1) proper disposal of feces; (2) fly control; (3) use of cooked foods and boiled or otherwise disinfected water only.

B. *Helminthiasis*

Owing to the different habits of life of the different worms, the preventive measures will have to be considered separately for each different type of infection. For the prevention of trichiniasis the measure of greatest importance is the production of pork free from infection. Inasmuch as the rat is frequently an intermediate host, rat control is a very important problem, and the piggeries and slaughterhouses should be rat-proof throughout. In addition, rats should never be fed to hogs, nor should hogs be fed uncooked offal. The ultimate consumer may protect himself also by having all pork thoroughly cooked before eating, in order to be sure that all the embryos have been destroyed. Trichiniasis is by no means as rare a disease as it is often considered.[2] Small outbreaks are not extremely rare, and routine examination of muscle tissue in pathological laboratories occasionally shows the presence of trichinae.

Measures aiming at control of tapeworm disease must be divided into several groups. First may be considered those appropriate to protection against Tenia saginata. This involves the proper disposal of human excreta, especially in the neighborhood of live stock; the inspection of carcasses and the condemnation of heavily infected animals; the storage of meat some weeks before consumption to kill any parasites that may be

[2] Williams, H. U. *Jour. Med. Res.* 6:64, 1901. (New Series, Vol. 1.)

present; and finally, the energetic treatment of human carriers of the disease. These measures also hold true for T. solium.

The problem of control of infection with H. nana is important and rather more difficult than that of the other tapeworm diseases, in that human as well as rat or mice feces may be a source of infection. Therefore, cleanliness in the handling of food and in personal habits is essential. It involves the control of rats and mice, not only in slaughterhouses but in cold storage plants and in retail shops. Prompt treatment and control of infected individuals and carriers is of great importance. In fact, in all of the parasitic diseases the importance of vectors cannot be overrated.

One of the most important economic problems presented by the parasitic diseases is that of hookworm,[3] in relation not only to the large numbers of individuals affected but also to the changes produced in them, both mental and physical. So far as the prophylaxis of hookworm disease is concerned, there are several general considerations on which the entire program of prophylaxis may be based:

1. If reinfection could be prevented the disease would be entirely extinct in from six to eight years.
2. The parasites are transmitted only through contamination with fecal material.
3. The infection is not rapidly acquired, but the worms gain entrance to the body a few at a time over long periods.
4. The worms do not gain access to the body by the usual methods but penetrate the skin directly.

[3] Bibliography of Hookworm Disease. *Publication No. 11*, International Health Board. 1922.

In order to utilize our knowledge effectively these four fundamental considerations should be the foundation of the program.

The most essential and the most practical method of attack is the control of infected material. The magnitude of this problem is strikingly brought out by the fact that a severely infected person deposits daily in the feces from one million to four million eggs. In most of the regions heavily infected with hookworm the conditions of living are relatively primitive and many sanitary measures are difficult to install and enforce. One of the most obvious and most important measures is the prevention of promiscuous defecation. In any program of this type particular attention should be given to the so-called natural latrines; that is, spots frequented day after day by individuals or groups of individuals. In Mohammedan countries, particularly, these are apt to be on the banks of streams, owing to the need for water in carrying out semireligious sanitary rituals. Incidentally, of course, the deposit of fecal material near small streams, where it may readily be washed into the current, is particularly favorable for the wide diffusion of the eggs.

The construction and use of the earth-pit latrine is one solution to this problem of proper control of fecal material. In the average rural community the earth-pit type covered with a fly-tight shed is the most satisfactory sort for agricultural workers in the field. There are certain circumstances, however, that make the earth-pit type of latrine unsuitable. In the first place, high level of ground water makes its use unsatisfactory in marshy land. In limestone regions where the strata are near the surface another type of difficulty is en-

countered. In small villages where efficient scavenger service can be maintained the pail type of latrine is the most satisfactory. However, no matter what type of latrine is established the work is only half done because constant inspection is necessary to enforce the use of the latrines and to keep them clean and in proper sanitary condition.

Sanitary measures are considerably aided by certain characteristics of the viability of the parasites. The immature larvae soon die unless they are kept warm and moist. The adult larvae, on the other hand, may live for a considerable time under unfavorable circumstances. Fortunately, neither the immature nor the adult larvae can stand prolonged immersion in water. Moreover, the character of the soil has an important influence on the growth of the larvae and on their viability. Sandy soil is particularly suited to their growth, but limestone regions are relatively free from infestation.

The next important measures must be centered on protection of the individual from contaminated material. The first and simplest measure is the wearing of shoes, which very greatly reduces the chances of infection by preventing the larvae from the grass and moist earth from gaining access into the body. The second is the cooking of all fluids and vegetables in infected regions before eating them. The final preventive measure is the reduction in number of infected individuals. Education of the people to the danger of the condition is essential before there can be any hope of success in the various measures put forth, because none of them can be carried out effectively without the cooperation of all members of the community. Wholesale therapeutic treatment is essential in infected regions.

The most satisfactory method is to give internal treatment to all persons within a given territory, then after an interval of some months to repeat treatment. In this way the disease can be virtually eradicated, and it is far more satisfactory than to treat only infected individuals, as invariably some are missed and serve as a focus of infection for those who may have been rid of the disease. There are certain places, such as mines, for example, where it is extremely difficult to prevent the spread of infection once it is started; therefore it is essential that only worm-free individuals be employed. The control of hookworm disease gives one of the most brilliant examples of the modern progress of preventive medicine and also shows how all branches of knowledge must be focused on a single point in order to work out a satisfactory program for control of a disease.

VI

PHARMACOLOGY

While pharmacology does not lend itself to preventive medicine so readily as do some other subjects, nevertheless there are several points worthy of mention. One of the most important of these from the practical standpoint is the matter of patent medicines. While the use of these is not as prevalent as it was some years ago, it is still a very serious factor in the community. It is important from the aspect of preventive medicine because the use of these patent medicines encourages people to attempt to treat diseases themselves which should be referred to a physician, with serious results to themselves when it is one of the degenerative diseases, and to the community when it is one of the communicable diseases. This last is particularly noticeable in cases of venereal disease.

Less now than formerly patent medicines are a cause of the formation of the drug habit, but even now they are a popular and important source of alcoholism.

A field more closely related to that of patent medicines than it should be is that of the proprietary preparations. The real field of the drug houses should be the preparation of superior pharmaceutical products. Unfortunately, however, the extensive commercializing of this field has resulted first in the widespread use of drugs, and second in the use of more or less inferior products. Thus, since the proprietary rights on veronal have expired, any number of barbituric acid compounds have appeared, some of which are closely related to, if not iden-

tical with, preparations which were earlier discarded in favor of veronal. Still another item is that of cost. Thus, there was a surprising difference between the cost of aspirin and acetyl salicylic acid, to a less extent still maintained. Too often the physician is guided in his choice of remedies by the detail man of the pharmaceutical house rather than by basic principles of pharmacy. While it is true that most of the proprietary drugs are excellent from the point of view of pharmacy, and do what they are supposed to do, it is well to remember that simpler and cheaper prescriptions may often serve just as well. In this connection the physician should have some good and definite reason for prescribing any preparation in the yellow pages of "New and Non-official Remedies."

The habitual use of cathartics might well be considered here, a self-perpetuating habit which becomes necessary once it has been established, and which, if the number of proprietary remedies advertised and on sale are any index, is extremely prevalent. The habitual use of cathartics certainly is not in accordance with the ideal ordering of the human economy and may well lead to definite pathological change. Unfortunately, some of the popular remedies for constipation are not what they seem; thus, in fine letters under the name of one preparation of agarol is the admission that it contains phenolphthalein. This is not in itself dangerous, but it is merely an illustration of the care necessary in using certain of the proprietary drugs. Occasionally, particularly in thin individuals, there are characteristic symptoms of colitis, apparently due to the excessive use of roughage such as bran and agar in the food, which

clear up after the use of these substances has been discontinued.

Another effect of the proprietary preparations is the indiscriminate use of those having analgesic results. The number of times that early symptoms have been disregarded, aspirin, veronal, or similar products being used, is considerable, and not infrequently the results are serious. It is hardly necessary to touch on the dangers of the widely known forms of drug habituation, such as those of the use of opium and cocaine, as they are thoroughly appreciated. However, there is another type of habit formation, not in the sense of morphine habituation, but rather an increasing dependency on drugs for sleep or relief from pain. Frequently in such drugs as acetphenetidine and similar compounds we tend to disregard the potentialities for danger because they are less familiar and far less dangerous than the opium or cocaine derivatives. There are a number of cases, particularly of headache, in which the symptoms may be perpetuated by the drug taken for its cure. (With regard to the habit-forming drugs, probably the various reports of the League of Nations give the most satisfactory discussion.)

In addition to the abuse of morphine its misuse should be considered, such as its administration for abdominal pain before diagnosis has been established, with the resultant danger of erroneous diagnosis.

The last few years, with the expansion of our knowledge of the vitamins and of endocrine preparations, have seen a vast increase in the number of products with more or less value, purporting to be veritable Aladdin's lamps when it comes to the reëstablishment of health. The widespread advertising of yeast is a

case in point. The question of vitamin deficiencies in the average American diet is yet to be definitely decided, and while in all probability the various vitamin preparations do not harm the users, it is yet to be proved just how valuable they are. One source of danger of the vitamin preparations and the so-called tonic, in particular, is their prolonged use in the early stages of serious diseases with disregard of symptoms, thus tending to prevent early and satisfactory treatment.

Many of the endocrine preparations are of dubious value. Most of the mixed preparations depend on thyroid for their efficacy, and in their use the danger of over-use of thyroid extract must be emphasized.

The question of the use of the various household antiseptics, particularly in the ever-widening fields that the advertising men find for them and are continually urging on the public, is a very serious one. More and more they are urging the use of the routine vaginal douche, for example, a procedure the value of which is open to serious question, and the dangers of which are perhaps not thoroughly appreciated. In the household use of antiseptics, on the other hand, is one of our most valuable means of prevention in infection of wounds. The bottle of iodine or other good antiseptic should be readily available, both in the home and in the shop. Much of the structure of modern surgery rests on the use of antiseptics, and the choice of those antiseptics for special purposes and the means of their application are as essential parts of the knowledge of the surgeon as is the knowledge of anatomy.

From the point of view of wholesale prevention of disease, there is probably no more important aspect of pharmacology than its relation to the prophylactic and

curative use of the various vermifuges, such as carbon tetrachloride in combating hookworm disease, the use of this chemical over large areas serving to restore the mental and physical health of the population and to prevent the endless cycle of infection and reinfection with hookworm. In the same way, wholesale prophylactic and curative use of quinine is very important in malarial regions, and is frequently the only means available for the control of the disease, owing to topographical or financial difficulties in the way of mosquito control.

Finally, pharmacology affords an opportunity for the consideration of various types of industrial poisoning and the proper means for their control and prevention. Particularly important among these are lead, benzol, arsenic, and phosphorus. A more complete discussion of these points will be found under the heading of industrial hygiene.

VII

PHYSICAL DIAGNOSIS

The physical examination of a patient should be utilized not only as an aid in the diagnosis of the immediate condition with relation to which the examination is being made, but in addition as a general check on the patient's condition. In other words, the idea of the health examination, so frequently advocated at the present time and found to be of definite value in many instances, should be carried over into the examination of the patient presenting definite signs and symptoms of disease.

There is no reason, for example, why, when an organic heart murmur is detected, the examiner should be satisfied with this and pass over such important but less striking conditions as faulty posture, obesity, and the like. In addition, not infrequently the physical examination may serve to bring out the evidence of the early lesions of disease hitherto unsuspected. Thus, urinary examinations frequently in older individuals show glycosuria or albuminuria, and detect diabetes or nephritis sufficiently early to institute valuable methods of control.

In spite of our emphasis on the complete physical examination, its rarity is all too marked. Valuable points may be brought out which would otherwise be missed, and which may add markedly to the well-being and comfort of the individual. Thus, an enlarged prostate may be detected before it gives rise to serious

trouble, or a carcinoma of the rectum may be discovered in time to treat it satisfactorily.

Perhaps as important to the comfort of the individual as anything is the condition of the feet. Yet this is a point frequently neglected, although in the course of the physical examination it is relatively easy to check up on the type of shoes used, and the condition of the arches.

The value of a complete physical examination extends also to a study of the special senses. The use of imperfectly fitted glasses is very prevalent, and while the average physician is not qualified to recommend the type of lens to be used, he can at least detect the existence of trouble and recommend a visit to one qualified to give treatment.

The physician himself in the technique of a physical examination has opportunity for practical application of preventive medicine. Thus, the need of prevention of cross-infection in the so-called communicable diseases, such as diphtheria and scarlet fever, is obvious, and in hospital wards a careful system of isolation and disinfection has been evolved. In a good many cases, however, these measures are not so carefully followed by the general practitioner as might be advisable. In the enteric and respiratory diseases the precaution against cross-infection is apt to be somewhat sketchy.

The history of the patient should also be considered, not only as a help in determining the nature of the existing disease, but also as a means of recognizing and avoiding any special hazards which may confront either the patient or the community. Thus, workers in certain industries are exposed to lead poisoning, and should be

taught how to avoid it. Certain of the textile workers have an unduly high death rate from tuberculosis. The individual with the more chronic infectious disease, such as tuberculosis, should be warned against the danger of infecting other individuals.

The relation to the family is also important. In such diseases as tuberculosis particularly, it is almost axiomatic that if one individual in a family has it, others have it whether it has been detected or not. In the same way evidence of syphilitic infection calls for a careful check on remaining members of the family.

In the past history of the individual may be found a number of points which indicate his susceptibility to certain types of disease. Thus, the particular aspects of hygiene which we tend to emphasize as resistance to disease may be exercised with profit, and various prophylactic measures instituted. Here, too, the matter of focal infections comes in, and it is of considerable importance in an individual presenting symptoms of heart or renal disease to rule out foci of infection. Conversely, in those presenting chronic sepsis in one locality or another it is very important to make a thorough examination to establish the degree of damage, if any, done to vital organs, and also to clear up the septic focus.

In addition, it is well to check up on such points as vaccination against smallpox and typhoid fever, and if possible to determine the susceptibility to such diseases as scarlet fever and diphtheria. It is considered a disgrace in the automobile industry for a salesman to let a prospective customer get out without buying a car. It is even worse from the point of view of the community for a doctor to have an opportunity to examine and

advise an unvaccinated individual without doing his best to see that he is vaccinated.

In considering the patient's habits, it is relatively easy to show him those which are of positive value and those which may be of damage to him. The forming of proper habits of eating, sleeping, and the like are too obvious to need mention.

VIII

MEDICINE

One of the most fertile fields for the cultivation of preventive medicine is that dealing with the large group of diseases ordinarily included in the instruction in clinical medicine. This group includes practically all of the diseases except those which have been separated and apportioned to the various specialties. These diseases can be divided in general into two groups: the infectious diseases and the degenerative diseases. Unfortunately this grouping cannot be hard and fast, for if it were rigidly adhered to there would be a considerable divorcing of related subjects from one another. However, for all practical purposes it can be followed with minor exceptions.

I. Infectious Diseases

The infectious diseases have certain points in common, such as the necessity for transmission of the infecting agent from one case of the disease to another, and variation in the resistance of the individual. The infectious diseases can perhaps best be grouped with regard to the organs which they attack. One of the most important groups in which preventive medicine has accomplished a great deal is that of infections of the gastro-intestinal tract.

Most important of the diseases falling in this group is typhoid fever, although bacillary and amebic dysentery are of very considerable importance. In addition, the paratyphoid fevers, botulism, cholera, and food

poisoning due to the Gaertner or related organisms should be considered. Practically all these infections have certain points in common for prevention: first, the ensurance of an adequate supply of pure water; second, protection and ensurance of an adequate supply of pure milk; third, prevention of foods from contamination by carriers of the various diseases; fourth, protection against transmission of disease by flies; fifth, protection of the individuals by vaccination in certain instances.

A. *Typhoid Fever and other Gastro-intestinal Infections*

Typhoid fever may perhaps be considered as the type for this group. One of the greatest triumphs of modern sanitation is the practical eradication of typhoid fever, which was for many years endemic in virtually all communities in the temperate zone.

However, typhoid fever is still a very formidable factor in increasing the mortality and morbidity rates. Unfortunately, until recent years at least, the United States has lagged considerably behind the majority of European communities. Gay,[1] in a study of a group of 31,000,000 Europeans in large cities compared with 21,000,000 inhabitants of American cities, found the average European mortality rate to be 6.5 and the American, 19.59 per 100,000. Interesting figures on the progress of stamping out typhoid fever in this country can be found in the various special articles published in the *Journal of the American Medical Association*[2] annually.

[1] Gay, F. P. Typhoid Fever. New York, 1918.

[2] Typhoid Fever in Large Cities of the United States. *Jour. Am. Med. Assoc.* **90**:1624, 1928.

During the last ten years it has been incontrovertibly proved that typhoid fever is a preventable disease and might be completely eradicated. Infection with typhoid fever inevitably means that the bacillus-laden excreta of a case or carrier have come into direct or indirect contact with something ingested by the patient. In the patient with typhoid fever, bacilli begin to appear in the intestinal discharges during the later stages of the incubation period. From this time on, they increase considerably in the intestine and reach their maximum about the time of the second week, to decrease only at the beginning of the period of convalescence. They sometimes remain for months or years thereafter. During the second and third weeks, in about one third of the cases, organisms appear in the urine as well. Other routes of distribution from the patient, such as sputum, may be disregarded as of no practical sanitary importance.

The recognized case of typhoid is usually well guarded from a sanitary point of view. As a rule, isolation is properly carried out, and disinfection of feces and urine is efficiently done. The most dangerous source of typhoid infection lies in the mild atypical case of the disease which is frequently unrecognized. It is possible that the widespread anti-typhoid inoculation of the male population during the World War has increased the occurrence of these mild atypical cases. Frequently they show nothing more than a very slight fever with minor intestinal disturbances and diarrhea. It is obvious that many of these cases will not be recognized or placed under typhoid precautions, with resulting opportunity for widespread dissemination of the organisms.

More important from the sanitary point of view, however, is the typhoid carrier. The carrier problem has been extensively studied in many cases. A recent valuable contribution is that of Garbat.[3]

In some of the chronic carriers there can be found no evidence that they have ever had the disease. As about 5 per cent of the cases of typhoid fever remain carriers, about 7,500 new carriers are added annually to those in the United States.

By far the most common localization of typhoid bacilli in the carrier is in the gall bladder, and possibly the intrahepatic bile ducts, as well, are common sites of localization of the bacilli. It is probable that the bile is infected from the hepatic circulation, although in some cases at least ascending infection from the duodenum is possible. There are also carriers who harbor organisms in the intestines. These are most commonly ones who have chronic intestinal ulcerations or chronic lesions of the appendix. In a few cases, urinary carriers have been found. The presence of the bacilli is usually associated with some pathological lesion of the urinary tract.

Carriers may increase enormously in the course of epidemics, especially among large groups of vaccinated people. The carrier problem will relatively increase in importance as sanitary measures reduce the wholesale method of distributing the bacilli in water, milk, and food.

In the arbitrary powers given boards of health to maintain isolation of carriers is seen definite recognition by the community of the importance of this problem. Innumerable attempts have been made to free carriers

[3] Garbat, A. L. *Monogr. Rockefeller Inst. No. 16.* New York, 1922.

from the bacilli by various medical and surgical means. In most cases it is probable that removal of the gall bladder will cause a cure. Various medicinal agents administered have been of practically no avail.

From the point of view of the individual the most important prophylactic measure in typhoid fever is inoculation with the dead organisms. The practicability of this measure was first demonstrated by Pfeiffer and others.[4, 5] Almost simultaneously Wright had carried out similar experiments in the English Army. In the four years up to 1900 almost 100,000 individuals were inoculated by Wright's method. The experience of the United States Army has removed any doubt as to the efficacy of typhoid vaccine. The Rawlins strain is generally used. A suspension of organisms, approximately one billion to the cubic centimeter, is killed by heating to 53° C. for one hour. One fourth per cent tricresol is added. For immunization, three doses are given at seven- to ten-day intervals, ranging in quantity from two hundred fifty million to one billion organisms at a dose. As commonly employed at the present time, about two hundred fifty million each of paratyphoid A and B are added to the dose. The lipovaccine introduced in France several years ago is of questionable value, and is now little used. Oral vaccination has apparently yielded brilliant results in the hands of Besredka, and will offer a most valuable method if the present work is confirmed.

Under ordinary conditions vaccination will protect from two to three years, but in the Army, under war

[4] Pfeiffer, R., and Kolle, W. *Deutsch. med. Wchnschr.* **22**: 735, 1896.
[5] Pfeiffer, R., and Marx. *Ibid.* **24**: 489, 1898.

conditions, single doses repeated every six months after the initial three doses would be advisable.

The general processes of prevention mentioned under the heading of typhoid fever could be applied to practically all of the gastro-intestinal infections.

Amebic dysentery has been considered in detail under the head of parasitology. Probably the most important point is the avoidance of eating uncooked food that may be contaminated with the amebae.

So far as cholera is concerned, purification of the water supply is the most valuable single measure. Proper disposal of the infected excreta and the suppression of flies are, of course, of great importance. We have, at the present time, no particularly efficacious method of protecting individuals against cholera. The vaccine of Haffkine [6] has definite value and has been tried very extensively in India. Vaccination protects for about two years.

The mode of transmission of bacillary dysentery has not been satisfactorily established. Flies are a very important factor, as are the carriers. D'Herelle's brilliant results with the bacteriophage have not been repeated in the hands of others.

Various epidemics of food poisoning due to the enteriditis group of organisms can be prevented by thoroughly cooking the food, particular care being taken in the food provided by caterers.

B. *Smallpox and the Acute Exanthemata*

The various so-called contagious diseases are perhaps best considered in connection with the subject of pediatrics, as most of the individuals suffering from them

[6] Haffkine, Protective Inoculation against Cholera in Calcutta, 1913.

are children. Scarlet fever, measles, mumps, chicken pox, and diphtheria will be included in that group. There is a very definite relationship between some of the infectious diseases and cardiac injury, which will be considered in connection with discussion of the circulatory system.

Smallpox should certainly be considered in this group as it is only through prejudice and ignorance that smallpox has not been exterminated entirely, since we have an absolutely effective measure for the prevention of the disease. While the etiology of smallpox is unknown, it has been known for hundreds of years that one attack of the disease protects against subsequent attacks. While dangerous, the method of deliberate exposure to the disease, or of inoculation, in the hope of inducing a mild attack was frequently used until the discovery of vaccination by Jenner in 1798. Jenner demonstrated in a number of cases that vaccination with the virus of cowpox would induce a mild local lesion which subsequently protected against smallpox. Since that time the identity of smallpox and cowpox has been a field of controversy. The present view is that cowpox represents merely an altered and attenuated form of smallpox.

There are numerous precautions necessary in the production of vaccine. In the first place, it is not always practicable to inoculate one human being from another. Moreover, occasionally syphilis has been accidentally transmitted by this means. At the present time virus is obtained from animals, chiefly calves from six months to two years old. Careful supervision to prevent the use of tuberculous animals is necessary. The utmost surgical cleanliness must be used throughout. Vacci-

nation of human beings is best performed by lightly scarifying the skin of the arm or leg with a sharp sterile needle. Intracutaneous injection of the virus diluted with water has been suggested by Wright.[7] This method gives a higher percentage of takes than the usual one.

It is hardly necessary to give evidence of the value of vaccination. Statistical compilations of this point are very numerous, and even in the daily press there are not infrequently news items relative to small outbreaks of smallpox which will illustrate the value of vaccination. It is advisable that every child be vaccinated before it reaches the age of eight months, and that vaccination be repeated at seven-year intervals thereafter.

Relaxation of the laws for compulsory vaccination has always led to outbreaks of the disease. In 1921 there had grown up a considerable unvaccinated population in Kansas City, and in that year there was an outbreak of the disease with 1,090 cases and 222 deaths. This outbreak was controlled only by rigorous widespread vaccination of the population.

C. *Pulmonary Infections*

There is one great group of infectious diseases which attack the respiratory system. The two most important members of this group are first, pneumonia, and second, tuberculosis. These two diseases have relatively little in common and are of sufficient importance to deserve detailed consideration.

1. *Pneumonia*

Owing to the number of conditions grouped under the name of pneumonia it is necessary to distinguish be-

[7] Wright, L. T. *Jour. Am. Med. Assoc.* **71**:654, 1918.

tween the primary and secondary types of the disease to discuss adequately the problems of prevention.

Primary Pneumonia. The typical primary or lobar pneumonia is almost invariably, in this climate at least, a pneumococcus infection. It has been recognized for over seventy-five years that pneumonia might be a communicable disease, although this view had not been generally accepted until the work of Neufeld and Haendel[8] in demonstrating different types of pneumococci, explained why many normal individuals harbor pneumococci in their mouths and throats. Investigators of the Rockefeller Hospital, notably Cole, Dochez, and Avery, have shown that the mouth organisms most commonly found belong to the least pathogenic group, Type IV, and that the majority of the cases of lobar pneumonia are caused by organisms of the first three types of pneumococci. This strongly suggests that lobar pneumonia is frequently caused by organisms transmitted from an extraneous source, and as a corollary that auto-infection cannot be regarded as very common. Since it is possible that the origin of many cases of lobar penumonia is due to the acquisition of a virulent strain of pneumococci either from a case of the disease or from a carrier, combined with a lowered resistance of the patient, the present laissez-faire attitude toward pneumonia is hardly justified. Morbidity and mortality statistics further emphasize the need for adequate preventive measures.

Pneumonia is due to a temporary coincidence of two factors: presence of virulent organisms and lowered resistance. Zinsser[9] states, "The disease will not occur

[8] Neufeld, F., and Haendel. *Arb. a. d. k. Gsndhtsamte.* **34**:293, 1910.
[9] Zinsser, H. Textbook of Bacteriology, p. 401. New York, 1927.

in an individual simply because he has received the virulent organism from a case or carrier, but in addition to this, there must be coincident hygienic defects that temporarily reduce his resistance." In most communicable diseases sanitary measures must be aimed particularly at the prevention of transmission of the pathogenic agent, with artificial immunization of the community wherever possible. Though the pneumonia vaccine of Almroth Wright has proved useful in South Africa, it is important to remember that there the population has little natural resistance to the pneumococci, and that there is no justification for expecting similarly brilliant results in this country.

It is evident from the number of carriers of pneumococci in our American communities that the resistance of normal individuals is high, thus differing greatly from their resistance to measles and other "contagious" diseases. Furthermore, there is great variation in the virulence of pneumococci, even single strains changing from virulent to avirulent organisms. This is, of course, in striking difference to such an organism as the diphtheria bacillus. We know that the disease will not occur in an individual simply because virulent organisms are present in his respiratory tract. There must be hygienic defects which temporarily depress his resistance. Therefore the aim of preventive medicine, so far as the control of pneumonia is concerned, should be to maintain normal resistance. In other words, we need not fear primary pneumonia in great prevalence or even in epidemic form except at such times as those of widespread financial stress or disaster, when many members of the community are unable to obtain proper housing

and food, or at times when large groups are crowded together under abnormal conditions, as in army camps.

So far as the prevention of pneumonia in individuals is concerned the most important point is the avoidance of undue exposure and overexertion. In caring for a case of pneumonia, it is well to remember that transportation of the pneumonia patient is very dangerous, and is one of the causes of the high mortality shown in hospital statistics.[10]

In the hospitals where there are large groups of individuals with temporarily lowered resistance, there is great difference in opinion as to the importance of isolation of pneumonia cases. At one extreme stands the report of the Chicago Pneumonia Commission;[11] at the other stands common present-day practice. From the point of view of the bacteriologist, cases of pneumonia should be isolated, at least by maintaining proper distance between beds, screening between beds, and care in the collection and disposal of sputum and the like. In view of the known persistence of the carrier state, especially for a month or more after convalescence, patients should be instructed in disinfection of their mouths and proper disposal of sputum. This last point, while not proved to be important, is nevertheless worth considering.

Secondary Pneumonia. While pneumonia may follow a number of diseases, there are only two of importance from the point of view of preventive medicine. These are influenza and measles. In any epidemic of either disease there are a number of pneumonia cases, chiefly of the lobular type, occurring as complications

[10] Moss, W. L. *Modern Hospital* 26:425, 1926.
[11] Pierce, C. C. *Ibid.* 25:487, 1925.

or sequelae. Both of these diseases show a certain degree of bronchial inflammation which strongly increases the susceptibility to secondary infection with virulent pneumococci and streptococci. However, the peculiar susceptibility of measles and influenza patients to pneumonia cannot be explained entirely on this basis. For some reason there is a marked depression of resistance to pulmonary infection far greater than in many other diseases involving the upper respiratory tract. Preventive medicine, of course, should be aimed at the prevention of the primary disease. Unfortunately, we know of no way to prevent influenza. However, so far as saving of life is concerned, prevention of secondary complications, particularly broncho-pneumonia, outweighs in importance the prevention of the primary disease.

For the prevention of pneumonia there are two important measures: first, keeping a case which may be coughing and spitting from transmitting its pneumococci or streptococci to others with upper respiratory tract infections; second, care of the measles or influenza sufferers to prevent lodgment of virulent organisms in their respiratory passages. There should be careful cleansing of the mouth of measles or influenza patients, both to prevent emission and to discourage lodgment of virulent organisms.

Gauze masks, although frequently advocated, are probably of slight value except in checking the discharge of very large droplets in coughing or sneezing. Influenza bacilli, streptococci, and other mouth organisms readily pass through some types of gauze mask.

Beds should be screened. Measles patients should be put to bed, kept warm, and protected from cold as soon

as the diagnosis is established. The same holds true for cases of influenza. Cases of secondary pneumonia occurring in a ward should be isolated, at least by screening. Thus, in secondary pneumonia, preventive measures must be aimed primarily at protection of specially susceptible individuals from organisms capable of causing the disease, and prevention of the dissemination of bacteria by cases of bronchopneumonia.

2. Tuberculosis

The field of prevention of tuberculosis is so extensive as to preclude any detailed consideration of the measures at our disposal. However, the more important of these can be briefly discussed; the need for emphasis on preventive measures is so great that fairly extensive consideration would be justifiable.

It is known that tuberculosis can be transmitted at all periods of life; that foci acquired in infancy or youth may be arrested, but may light up in later years when the individual is subjected to unfavorable environmental conditions. Infection may be direct; or it may be indirect, through contaminated food, fomites, or dust. In childhood it may be acquired through milk from infected cattle. The most common path of infection is by way of the respiratory tract, and to a lesser degree through the digestive tract.

Education is the basis of prevention of tuberculosis. This education should comprise the method of infection and the importance of economic and other factors as they determine habits of life. The prevention of direct infection is relatively simple: through isolation of infected individuals, at least so far as it is necessary to control the infectious material originating from them;

through care and disinfection of sputum; through prevention of spitting in public; and through the proper control of public eating places. All of these measures may be considerably aided by control of the tuberculous individuals through the compulsory notification of the disease.

The public must be educated to know that tuberculosis is curable providing the diagnosis is made early and proper treatment instituted. They must be educated to the need for public diagnostic clinics for tuberculosis. The need for adequate facilities for treating cases of the disease is well recognized. At least in our cities ample playgrounds and parks should be provided. Opportunities for city children to spend a portion of the summer in the country would be of great value. The nutrition of children in the public schools can be so supervised as to prevent undernutrition.

The late Commissioner of the Massachusetts Department of Public Health, Eugene Kelley, in 1922 outlined the following program of what he believed worth while for a state-wide campaign for the eradication of tuberculosis:

1. State sanatoria for the care of early and of late cases.
2. Open-air schools for children in the early stages of tuberculosis.
3. Dispensaries in towns of over 10,000 population for the discovery and supervision of cases of pulmonary tuberculosis.
4. Consultation clinics affording the services of specialists for early diagnosis.
5. Examination clinics for the examination of school children who are under weight or anemic.

6. Public health nurses for follow-up work connected with the above-mentioned institutions.

7. Home visiting and instruction of individuals and families in home care of cases of the disease.

In addition, of course, there should be efforts to improve housing conditions, to improve the sanitation of factories and shops, and finally to develop an adequate supply of well-trained physicians who possess sufficient skill in early diagnosis to detect cases of the disease while chances for cure are still good. It can readily be seen from this that the prevention of tuberculosis is only in small part a medical problem, and is far more an economic and social problem.

One method which may be of value in the prevention of the disease is still in its experimental phase, the vaccine of Calmette,[12] "BCG." Judging from his results with cattle, and from clinical experience with infants over the last five years, it appears to be of very definite value, and it may be that in time we shall possess an adequate method for wholesale immunization in infancy.

D. *Other Infectious Diseases*

Syphilis, one of the most important of the infectious diseases, has been considered as a specialty, and the consideration of this particular disease will be taken up under the heading of syphilology.

Two diseases having some relationship with the infectious group but other relations with the degenerative group will be considered under the headings of heart disease and nephritis.

[12] Calmette, A., and Guerin, C. *Ann. de l'inst. Past.* **38**: 371, 1924.

Poliomyelitis and encephalitis are too little understood to be profitably considered from the standpoint of prevention.

Rabies should perhaps be considered here. Rabies is infectious for practically all mammalia. It is usually transmitted through the saliva of a rabid animal coming in contact with a break in the skin or mucous membrane. There are two aspects to the prevention of rabies: one the general, the other the specific. Suppression of the stray dog, enforcement of licensing of dogs, and the use of muzzles or restraint if necessary, should be important factors in reducing the prevalence of the disease.[13] The prophylactic immunization of dogs is also of value. In other sections of the country than the East, particularly the Southwest, there are skunks and other wild animals which are carriers and the problem of control is rather more difficult. From the point of view of specific therapy the first and most important step is thorough cauterization of the bite, preferably with fuming nitric acid. In addition, the biting dog should be captured for observation for symptoms of rabies, and the brain examined, on death, for the presence of Negri bodies. Since one third of the persons bitten by dogs die, unless treated by the Pasteur treatment, this prophylactic measure is of great importance. Treatment at the present time varies but little from that originally established by Pasteur and consists essentially of repeated inoculation with attenuated virus. In a ten-year period 50,000 people have been treated, with a mortality of 1 per cent.

[13] Rosenau, M. J. *N. E. Jour. Med.* **198**: 787, 1928.

II. The Cardiorenal Diseases

A. *Heart Disease*

The problem of the prevention of heart disease cannot well be narrowed to the ultimate aim of stamping out heart disease, but it must consider as well the care of the chronic cardiac patient to prevent the development of injurious complications and particularly decompensation. The vast majority of the cases of heart disease in individuals under thirty-five years of age in New England, and in similar climates, is due primarily to the rheumatic virus.

The rheumatic virus may gain entrance to the circulation as a result of rheumatic arthritis, tonsillitis, and, in very young children, certain ill-defined insidious infections.

The etiological diagnosis of heart disease is a very important point not only because it results in a clearer understanding of the pathological changes in the heart and the probable clinical course, but because it is naturally of prime importance in the inauguration of campaigns against heart disease for protection of the individual. As in some other diseases in which we have knowledge of the infectious agent even more complete than in the case of rheumatic fever, notably in pneumonia, we have not as yet been able to apply that knowledge to the prevention of the disease with any degree of success. However, there are certain points which we have learned that are of proved value in the prevention of endocarditis due to the rheumatic virus. First is the value of tonsillectomy in childhood if the tonsils show evidence of infection, as the association between tonsillitis and heart disease is striking. Supplementary to

this, all infections of the throat in childhood should be treated as serious, in that they may afford an opportunity for entrance of the rheumatic virus to the body.

A second important point is the need of prolonged rest in bed together with the usual hygienic precautions in all cases of rheumatic fever, chorea, and even mild joint involvement. There is not a little evidence that the so-called "growing pains" of childhood may be a manifestation of a mild type of rheumatic fever. In any case in which acute endocarditis has developed, absolute rest prolonged for many months is of vital importance.

On the basis of well-established statistical reports showing rheumatic heart disease to be particularly prevalent in such climates as those of New England and England, together with the recent work of Smily and of Jordan showing that climate apparently has little influence on upper respiratory tract infections, there must be some other important factor than respiratory infections facilitating entrance of the rheumatic fever virus to the body.

In the prevention of acute and subacute bacterial endocarditis the clearing up of focal infections, particularly the removal of infected tonsils, is the most valuable measure, the fact being kept in mind that subacute bacterial endocarditis frequently develops in a heart previously damaged by the rheumatic virus. The importance of rest and constant observation of the heart by the attending physician in cases of infectious diseases should be emphasized.

Syphilitic involvement of the heart and aorta can usually be avoided by prompt and thorough treatment of the primary infection. Similarly, toxic myocardial damage due to diphtheria can be prevented by prompt

and adequate treatment with antitoxin and by rest. In the case of hyperthyroidism, remedy of the disturbed metabolic condition before damage has been done to the heart is indicated. The possibility of damage to the healthy heart from severe physical exertion is a much disputed point, but in the untrained individual at least, extreme physical exertion is to be avoided.

In the consideration of chronic heart disease it is well to remember that modern treatment, with the exception of the treatment of actual decompensation, is almost entirely centered upon prevention of further harm, particularly through cutting down the work of the heart by restricting activity to the point where the damaged organ is able to maintain adequate circulation without additional injury. Perhaps heart disease shows more strikingly than any other condition the difficulty of drawing a line between preventive and proper therapeutic measures. In chronic valvular disease the course is closely dependent on the degree of intelligent regulation of the individual's life, somewhat analagous to the situation in arrested tuberculosis. Not only physical strain but worry, anxiety, insufficient sleep, excessive eating, and alcohol to excess should be taboo. It is rarely safe to deal in generalities when prescribing the mode of life for the cardiac patient, and it is advisable to have an exact detailed program and to have the faithfulness of the patient in carrying out this program frequently checked.

As yet in the degenerative types of cardiac disease, due in part at least to arteriosclerosis or hypertension, we have no real knowledge of the etiological factors involved and consequently no set basis for a preventive program. However, we know that certain factors such

as excessive mental and physical strain and overeating not only accelerate the degenerative changes, but frequently lead to the termination of existence. The clearing up of focal infections is also important.

B. *Nephritis*

In nephritis the methods of prevention are applicable only in diseased conditions in which (1) the etiology in the sense of cause, whether specific or general is known, and (2) the causative factor can be eliminated.

Acute Nephritis. Infections of various sorts cause most of the cases of acute nephritis. Infections of the upper respiratory tract, including the common cold and tonsillitis, seem the most frequent causes. Infections of the sinuses and teeth are more infrequent causes. A certain number of cases develop following diphtheria, pneumonia, and erysipelas. A number follow the acute exanthemata, especially scarlet fever. In all of these the streptococcus group of bacteria play the most important rôle. Complications of pregnancy may cause a certain type of acute renal lesion. Other causes have been assigned, but of them we have no real knowledge.

In regard to these infections preventive medicine has a relatively small rôle. Too little is known about the common cold and infections of the upper respiratory tract in a preventive sense to be able to advise other than good hygiene and so far as possible avoidance of the possibilities of contact infection. With regard to scarlet fever, the possibility of detecting those susceptible by the Dick test and subsequent immunization by toxin if indicated should cut down the occurrence of scarlet fever, and in this way reduce the incidence of

this possible cause of nephritis. It is probable that prompt treatment, particularly with rest in bed, is the best method of decreasing the probability of acute nephritis in the train of these various infections. As to why renal lesions arise in the course of pregnancy, but little is known. However, prompt treatment and, if necessary, termination of the pregnancy are the best available means of preventing serious degrees of renal disturbance.

Chronic Nephritis. The factors that have been enumerated in the etiology of acute nephritis seem to play a causative part in cases beginning as subacute nephritis and progressing to a chronic stage, and the prevention of this group is to be managed as already described for acute nephritis. It is to be realized, however, that this type of nephritis makes up an extremely small part of the group of chronic nephritis, and consequently preventive methods in this group even if effective, will have very little influence on the incidence of chronic nephritis in general.

With the exception of the group just referred to, chronic nephritis apparently begins insidiously, with no definite relation to any sort of acute process. It is rare for a history of a preceding attack of acute nephritis to be obtained. Consequently, very little of what has been said up to the present time is applicable to most cases of chronic nephritis, except in so far as the various acute infections injure body tissues and body resistance, and hence should be prevented so far as possible.

The ordinary type of chronic nephritis is really part of a generalized vascular disease, and in its production antecedent infections may play a part, though for this we have little definite satisfactory evidence. There is

a certain amount of evidence that high protein diet is a causative factor, and consequently excessive protein intake should be avoided. However, it should be realized that even the causative relationship of high protein feeding is uncertain, and there is considerable doubt about its importance so far as animal experimentation is concerned. There is sufficient clinical evidence, however, to make a balanced diet not too excessive in protein a preventive measure to be given weight in the chronic nephritis problem.

Hypertension seems in a certain number of cases to predispose to the development of a chronic nephritis. As to the cause of hypertension, almost nothing definite is known at present. Wear and tear of high-pressure living is a probable factor and this can be subjected to preventive measures. However, heredity seems a more important causative factor, and this is but little influenced by measures of preventive medicine. Obesity may possibly have a causal relation. When hypertension appears, a general reduction in high-pressure activities of mind or body is the only measure that we know of for retardation of the progression of arterial lesions and for possible prevention of a subsequent chronic nephritis.

With so little available for the actual prevention of the causes that lead to acute nephritis, and with so little known as to the real causes of the vast majority of cases of chronic nephritis, preventive medicine at present is in a pretty helpless state so far as the nephritis group is concerned. Obviously, there is far more place for investigation as to means of prevention of these various acute infections and for study of the causes of

chronic nephritis than for instruction as to means of prevention and for preventive propaganda as applied to nephritis.

C. *Arteriosclerosis*

Closely connected with the problems of heart disease and kidney disease is that of arteriosclerosis. Unfortunately, our knowledge is extremely limited and various etiological factors which have been proposed have been ruled out. There is little probability that our knowledge will be strikingly advanced in the next few years, and so far as we can see at the present time we can go only on supposition. However, the importance of this condition is sufficient to give weight to hypotheses that perhaps would not be considered in relation to less important diseases. It is unlikely that there is any great danger in high protein or salt intake. There apparently is some relation between nervous strain and hardening of the arteries. Then, too, we know that certain of the metabolic diseases, such as diabetes, have a definitely predisposing relation to arterial degeneration.

III. The Degenerative Diseases

A. *Malignant Disease*

Our ignorance of the underlying cause or causes of malignant disease is so great that most of our prophylactic measures must be aimed more or less in the dark. Early diagnosis is probably the most important measure to reduce mortality at the present time. In certain types of disease, such as carcinoma of the cervix, the chance of a cure diminishes 4 per cent for each week that passes after symptoms have been noted. Cancer is first a local disease, and it is only while it remains a local

disease that there is any hope of cure in its treatment. At the present time, education of the people to recognize early suspicious symptoms, and education of the physician to recognize and determine positively whether these symptoms are due to malignancy or not, and to treat them properly and promptly if they are malignant, offer the best hope of lowering mortality from this group of diseases. Of preventive value is the clearing up of any source of chronic irritation such as a lacerated cervix, a jagged tooth, or a badly fitting plate. Further detailed consideration of preventive measures will be found in the sections under pathology and surgery.

B. *Diseases of the Blood*

1. *Pernicious Anemia*

While the cause of pernicious anemia is not known, its cure is known, and, moreover, the same substance used as a cure, namely liver, is efficacious as a means of prevention of the disease. There are certain conditions that may perhaps be considered as pre-anemic stages of pernicious anemia. Chief among these is achlorhydria. It probably is of definite value to feed hydrochloric acid and to include a moderate amount of liver in the diet of the individuals found to be suffering from achlorhydria. Beyond this we cannot go at the present time.

2. Secondary Anemia

In secondary anemia, there is a wide field for the prevention of disability through the detection and removal of the cause. One of the most frequent, important, and easily remedied of all the causes is bleeding hemorrhoids. The relationship of diet to secondary anemia should not be overlooked.

C. *Metabolic Diseases*

1. *Diabetes*

The problem of diabetes is becoming more important as a larger proportion of our population acquires the means and desires of luxurious living. While the immediate etiological factors of diabetes are as yet unknown, we do know that it is definitely associated with certain conditions. The diabetic death rate and therefore, presumably, the mortality rate is lower for those doing manual labor, and is distinctly higher for those who combine sedentary occupations with luxurious habits of living. Obesity, according to some authorities, is a very important factor, and although some students of the disease differ somewhat on the importance of this point, nevertheless it is unquestionable that diabetes develops in overweight individuals much more frequently than in others. Heredity apparently plays some part, and it is quite possible that by careful attention to the habits of individuals with a family history of diabetes they may be saved from the disease that might well have followed carelessness in eating and living.

From studies of the pathological anatomy of diabetes there appears to be strong evidence that we are dealing with a disease of toxic rather than infectious origin, and that the injurious agent acts over a considerable period of time. From the standpoint of the individual case, it is well to remember that the longer diabetes persists the milder it becomes, so that every effort should be made to tide the patient over the initial stages. For all practical purposes the first year is the danger year. Not infrequently life insurance examination and periodic

health examinations detect sugar in the urine of otherwise healthy individuals and thus in many instances enable them, by early attention to this sign of disordered function, to prevent the appearance of the disease in a severe form. Once the diagnosis of diabetes has been established the problem of prevention shifts from the prevention of diabetes itself to that of its complications. The discovery of insulin has left little excuse for the death of any individual from uncomplicated diabetes either from malnutrition or coma. Coma can be prevented in practically all cases by adequate dietary treatment and insulin. In the case of the diabetic patient at the present time the three most pressing problems are prevention of infection, of gangrene, and of arteriosclerosis. The proportion of deaths from these conditions has necessarily risen as the diabetics have been saved from acidosis and coma.

As regards the prevention of arteriosclerosis we can do little. However, it is perhaps justifiable to adopt as a working hypothesis Aschoff's modification of Virchow's theory, namely that infiltration of the ground substance of the intima of the arteries by plasma is the initial lesion. On this basis plasma laden with lipoid droplets would be particularly pernicious. It is well known that many cases of diabetes show lipemia. This lipemia can be produced by a number of causes: by the feeding of a high fat diet, by a poorly balanced diet, or by extreme malnutrition. We can therefore assume for a working hypothesis that one possible source of arteriosclerosis in diabetic patients is lipemia, and that the blood lipoids can be kept from rising to high levels by well-balanced diets, of adequate but not too high caloric value.

Gangrene is of course almost inevitably associated with arteriosclerosis. However, there are certain important points to keep in mind in the prevention of this condition.

The following precautions laid down by Joslin[14] have been found to be extremely valuable. It is well to remember that in diabetes cleanliness is not only next to godliness, but absolutely essential to continued life on earth.

1. Wash feet daily with soap and water. Dry thoroughly, especially between toes.

2. When thoroughly dry, rub well with hydrous lanolin, as often as necessary to keep the skin soft, supple, and free from scales and dryness. If nails are brittle and dry, soften by soaking in warm water one-half hour each night, apply lanolin generously under and about nails, and bandage loosely. Clean nails with orange-wood sticks. Cut nails straight across and avoid injury to the toes.

3. Wear shoes which do not bind or rub. Wear new shoes one-half hour only, on the first day, and increase one hour daily.

As regards cuts and breaks in the skin he advises:

1. Thorough cleanliness with soap and water.

2. Avoidance of strong irritating antiseptics, such as sulpho-naphthol and iodine.

3. Covering with lanolin on sterile gauze under a light bandage.

4. Using the foot as little as possible until wound is healed.

[14] Joslin, E. P. The Treatment of Diabetes Mellitus (3d ed.). Philadelphia, 1928.

2. *Thyroid Diseases*

(*a*) *Cretinism*

Since cretinism is a congenital disease it is difficult to prevent it. On the other hand we know that it shows a marked hereditary tendency, so by the discouraging of intermarriage of individuals with a family history of cretinism much should be done to wipe out this condition. Once a cretin is born, however, the use of thyroid extract to supply the deficient secretion of the thyroid gland will enable him to attain more nearly normal growth.

(*b*) *Myxedema*

Myxedema is due to insufficient thyroid secretion. We are very fortunate in having available an active preparation of the thyroid gland, so that it is possible by its administration to prevent the appearance of the symptoms and usually to make the individuals, for all practical purposes, normal.

(*c*) *Endemic Goiter*

The studies of Marine [15] and others have shown that endemic goiter can be prevented by the including of a slight amount of iodine in the diet. The infectious theory of McCarrison will probably have to be discarded. This iodine may be administered in many ways. The favored, though rather wasteful, method is that of adding a small amount of iodine to the drinking supply. Still another method is to give definite doses of iodine to the school children two or three times a year in endem-

[15] Marine, D. and Kimball, O. P. *Jour. Lab. and Clin. Med.* 3: 41, 1918.

ic goiter districts. A third method, and perhaps as effective as any, is the use of iodized table salt.

(*d*) *Hyperthyroidism*

In hyperthyroidism we have to consider not only the prevention of the condition itself but the prevention of its almost inevitable sequelae, thyroid toxicosis and myocardial injury. Surgery is in most cases the best treatment, both to effect a cure and to prevent complications. Sometimes in severe cases of hyperthyroidism, where the operative risk is frequently great, it is well to use a valuable measure which has recently been discovered, namely, the administration of Lugol's solution as a preoperative routine. This causes a definite amount of involution of the hyperactive gland.

D. *Deficiency Diseases*

With our increasing knowledge of the importance of the vitamins, the field of the deficiency diseases has steadily widened. This group of diseases is, perhaps more than any other, one wherein individual prophylaxis is of great importance, as the occurrence of these diseases is dependent solely on the food intake of the individual.

1. *Scorbutus*

Fully one hundred and fifty years ago it was recognized that fresh citrus foods would prevent and cure scorbutus. It was only after Funk's demonstration of the dependence of the animal organism on the accessory food substances or vitamins that the nature of this preventive and curative action was fully recognized. With the knowledge that vitamin C deficiency is the under-

lying cause of the scurvy, it is simple to prevent the occurrence of the disease by maintaining an adequate intake of such material as contains a reasonable amount of this vitamin. Orange juice at present is the most readily accessible substance rich in this vitamin.

2. *Beriberi*

Although beriberi is practically unknown in the United States, it is endemic in the far East, in a portion of Africa, and in Brazil. Since beriberi is directly caused by an improper diet and can be readily prevented by a proper one, the suffering and economic loss which it entails are a needless sacrifice. The anti-neuritic vitamin has been shown to be contained in a large number of substances. With the use of undermilled rice or the addition of various beans and peas or yeast to the diet, the disease may be readily controlled. As yet the vitamin assumed to be water soluble B has not been isolated and sufficiently studied. It is barely possible that there may be two vitamins involved, one of which prevents the dry form of the disease and one the wet form. Our practical knowledge and its application have outstripped our theoretical knowledge, and although we are not as yet certain of the exact vitamins involved, we nevertheless can control the disease by simple dietary measures.

3. *Pellagra*

The work of Goldberger and others has established that pellagra is essentially due to a faulty diet, and that probably the primary fault is a vitamin deficiency. It has long been recognized that poverty and rural life are associated with the disease, and evidence has gradually accumulated to show that the more restricted diet

of the poor in the rural districts is the underlying cause of the disease. Fresh meat, milk, and eggs are apparently of greatest value in preventing pellagra.

4. *Rickets*

This disease will be considered at length in Chapter X, Pediatrics.

E. *Occupational Diseases*

In the occupational diseases the first essential is to recognize the source of danger. This is usually obvious, but is sometimes difficult; for example, intoxication may arise from benzol fumes although neither employees nor employers recognize that the "dope" with which they treat leather contains benzol.

Once the source of danger is recognized the problem of its control is half solved. There are certain fundamental protective measures applicable to all of the occupational diseases. These may be summed up as adequate ventilation, insistence on cleanliness of the individual employees, and adequate precautions against traumatic injuries.

Measures for the control of lead poisoning may be taken as an example of the means of prophylaxis of the occupational diseases, as this is one of the oldest and most important of the so-called industrial poisonings. Lead is rather typical of the cumulative poisons, and the disease is chronic and insidious to a marked degree. Practically all forms of lead are poisonous, although the basic carbonate and the suboxide are the most dangerous. The "Lead Studies" by Aub [16] and his colleagues,

[16] Aub, J. C. and Others. Lead Poisoning. Medical Monographs, vol. vii. Williams and Wilkins Co., Baltimore, 1926.

and Hamilton's "Industrial Poisons in the United States" [17] have done much to clear up our knowledge of the disease.

The chief method of absorption is through the inspired air. The elimination of lead is slow, and while it can be eliminated if only minute amounts are ingested, excess of intake over excretion gives rise to an accumulation of lead. However, no matter how lead is absorbed it is stored in the bones, particularly if there is an abundant amount of calcium in the diet. There is also evidence that calcium in the diet tends to prevent absorption. Thus, milk may be a very valuable food in lead poisoning.

The prevention of lead poisoning depends on the protection of workmen from lead dust and fumes, and on provisions for keeping their bodies and clothing clean. In other words, the first requisite is to keep the workman's surroundings, including the air which he breathes, free from lead; and the second is to keep his immediate person free from lead. In addition, a rich milk diet is of considerable value in fixing the lead in inert form in the bones. The protective measures advised by the Massachusetts Department of Public Health are perhaps as concise as any that can be outlined, and are given below.

The poison gains entrance into the system:

1. By the swallowing of minute particles of lead.
2. By inhalation of lead dust or the fumes of lead in a molten state.
3. By absorption from the skin in handling lead.

[17] Hamilton, A. Industrial Poisons in the United States. New York, 1925.

Advice to employees:

1. General personal cleanliness is of the first importance.

2. Thoroughly clean your hands before touching food and before leaving the workroom.

3. Thoroughly rinse your mouth before eating.

4. Take good, nutritious food and plenty of milk.

5. Take a substantial breakfast; an empty stomach is more susceptible to the poisonous effects of lead.

6. Never eat at your work. Eat your luncheon outside of the workroom if possible; if not, in a part of the room away from the lead. Never smoke or use tobacco in any form while at work.

7. Avoid all excesses; alcoholic beverages are especially injurious.

8. Wear overalls or a long coat at your work; also a cap or some head covering. Whenever possible wear gloves when lead is to be handled.

9. Persons working in white lead or other powdered compounds of lead should always wear a respirator while at work. Cause as little dust as possible.

10. Consult a physician at the first sign of ill health.

Advice to employers:

1. Provide washing facilities, lockers, and a place for the employees to eat luncheons away from lead.

2. Provide respirators for all the workers who have to handle white lead or other powdered compounds of lead.

3. The floors of the workrooms and benches at which men work should be cleaned daily after thoroughly moistening them.

4. These regulations should be posted in a conspicuous place in the workroom.

IV. General Prophylactic Measures

A. *Periodic Health Examinations*

The first plea for periodic health examinations was that by Dobell [18] in 1861, wherein he laid down the theorem that by early diagnosis of disease or by early treatment life may be prolonged considerably. There is a great deal of evidence available regarding the influence of minor disabilities on duration of life, and probably the most familiar example of this is the so-called "focal infection," unimportant in itself, but a potent factor in the production of disease. Then there are many minor impairments, such as a slight amount of albumin in the urine, occasional glycosuria, moderately elevated blood pressure, functional heart murmurs, which in themselves are of little significance, and which the physician is inclined to discount as of little importance, but which studied in mass, as is possible through life insurance statistics, show a definite impairment of the individual and a definite shortening of his life.

The chronic degenerative diseases are steadily increasing, and we know that many of the so-called minor impairments are precursors of them. Furthermore, early diagnosis is of the utmost importance in the group of degenerative diseases. It is worth while to remember that the difficulty of reëstablishing functional efficiency is proportionate to the pathology already present. In the malignant diseases time is one of the most impor-

[18] Dobell, H. Lectures on the Germs and Vestiges of Disease and on the Prevention of the Invasion and Fatality of Disease by Periodical Examination. London, 1861.

tant factors. Thus, Leland has brought out that the chances of cure for carcinoma of the cervix diminish 4 per cent a week.

Particularly in early disease is diagnosis difficult, and nowhere more than in the examination of supposedly healthy patients is skill more severely taxed. We are only now beginning to practice what Sir James Mackenzie so long taught, that before a disease entrenches itself is the time to treat it, and our insight into disease is best obtained from study of its beginning. Thus, periodical examinations react not only to the benefit of the patient, but to the benefit of the physician, increasing his diagnostic skill and aiding his prestige. From the point of view of the patient it is far more valuable, even though perhaps not so much appreciated as a spectacular cure of some fully established disease. However, the carelessly done physical examination is worse than none at all. It is absolutely essential that a periodical examination be made as completely and thoroughly as is humanly possible. Only too often the examination of the sick patient is extremely casual, and the temptation to make this casualness even more marked is far too apparent in the examinations of healthy individuals.

B. *Life Insurance Examinations*

One way in which the average man is forced to take account of stock on the physical side is the examination insisted on by practically all of the insurance companies.[19] Unfortunately, the individual too often considers defects found through life insurance examinations only as flaws picked by the medical director.

[19] Life Insurance Medicine. New England Mutual Life Insurance Company. Boston, 1926.

The physical examinations given are frequently of a cursory character, noting only the more obvious pathological conditions. On the other hand, through the urine analysis, which is usually well and carefully performed, there is a fair index as to certain conditions, such as diabetes mellitus and chronic nephritis.

The chief defect, however, lies in the fact that the individual whose application for insurance has been rejected is too often apt to let things slide instead of following up the rejection with a careful examination and adopting a regimen suitable to the disease condition. However, in many cases the shock of finding a physical defect is sufficient to drive the rejected individual to change his mode of life so as to effect an arrest, if not a cure, of the disease process.

IX

SURGERY

I. Surgical Technique

All too often the technique of surgical asepsis and antisepsis is carried out as a mere ritualistic performance, with the fact that it is fundamentally based on the prevention of sepsis forgotten. With the vast number of surgical operations being performed, and the dire possibilities that lie in infection of surgical wounds, there is probably no field of greater immediate importance to the individual than that of surgical technique, from the point of view of prevention. Anyone who has had the disheartening experience of a patient with a clean laparotomy dying from a streptococcus infection, or a patient dying of gas gangrene after an amputation, realizes the tremendous importance of these measures made possible by the genius of Pasteur and Lister. The whole aim of surgical technique is prevention, the prevention of access of pathogenic organisms to the exposed or traumatized tissue. The value of the skin or mucous membranes as barriers against infection is axiomatic, and as a converse the danger of a break in the skin or mucous membrane is obvious. The preoperative preparation of the field of operation should be made with a clear understanding of the underlying problem; the region should not, as is only too often the case, be scrubbed so many minutes with such and such a solution, and so many minutes with some other solution just because it has always been done. The use of sterile gauze, again, is so obvious that we hardly give it a

thought, yet the least slip in sterilization may give rise to extremely dangerous infections. The sterility of instruments is too obviously important to need mention.

One of the most interesting phases is the use of masks. There are three types of mask in common use: first, several thicknesses of gauze filling, from four to eight; second, six to twelve thicknesses of gauze in padded form placed within two longer layers of gauze; and third, a pad of cotton between two layers of gauze. The more common type of mask appears to be that where several thicknesses of gauze are used with formation of a pad. A mask of this type does hold back droplets of moisture of the larger size, but experiments have proved that it does not hold back organisms sprayed from the mouth in forced breathing or in conversation. Use of this type of mask gives a false sense of security to the surgeon and little protection to the patient. At best, almost any type of mask becomes saturated with moisture and any great expiratory effort will spray some of this bacteria-loaded moisture over the field of operation. The most satisfactory type of mask appears to be that of a gauze or cotton pad held in place by one or two layers of gauze, but even this is not infallible.

II. Anesthesia

The choice of the anesthetic for a surgical operation is based primarily on the evidence obtained from a complete history and physical examination of the patient. Especial care is to be exercised in the examination of the respiratory tract for evidence of past or present infection. The heart and circulation demand consideration chiefly from a functional standpoint. A routine

urinalysis affords indications of disease of the kidney or of diabetes. In addition to the examination of the patient, any unusual aspects of the case from an operative standpoint are to be borne in mind. The site of the field of operation; the degree of muscular relaxation required; the liability to the occurrence of shock or hemorrhage; and the possibility of such emergencies as the unintentional opening of the pleural cavity — all bear upon the choice of the anesthetic. The anesthetic of choice from the standpoint of an existing cardiac complication may well prove to be the most dangerous to the patient if it imposes technical difficulties on the actual operative procedure because of an inadequate degree of muscular relaxation.

A. *Preliminary Medication*

Subcutaneous injections of morphine are commonly used in preparing the patient for the administration of an anesthetic, as this drug serves to allay his fears and apprehensions. If used in too large doses its action as a respiratory depressant may cause difficulties, particularly during the course of a light anesthesia. Scopolamine, or hyoscine, produces a marked sensation of drowsiness and is frequently used as a preliminary medication in operations to be performed under nitrous oxide or a local anesthetic. Occasionally the use of scopolamine is followed by collapse and at times by excitation of the central nervous system instead of depression. Atropine is routinely used to diminish the amount of nasopharyngeal and bronchial secretions.

B. *General Anesthetics*

Ether.[1] Ether is the most extensively used general anesthetic in the United States. Its chief merit lies in the wide margin of safety which exists between the stage of complete surgical anesthesia and the occurrence of dangerous depressant effects on the heart and respiratory center. Added to this, the relative ease of administration makes it the anesthetic of choice in the hands of anesthetists without special training. On the other hand, ether is an irritant to mucous membranes and may provoke a reaction in the sensitive lining of the trachea and bronchi which plays a part in the causation of postoperative pulmonary complications.

The stage of excitement with ether is at times prolonged and even violent. In patients accustomed to taking large quantities of alcohol, it may be almost impossible to induce a deep anesthesia with ether. On account of its inflammability the use of ether must be surrounded with adequate safeguards if an actual cautery is brought into the room.

Chloroform. Although chloroform is still used extensively in England, its use has never met with popular favor in the United States or on the Continent. The margin of safety between complete surgical anesthesia and the depressant effects of the drug is much less than that with ether. The power of chloroform to arrest the respiration is three times as great and the depressant action on the heart is about twenty-five to thirty times that of ether. In addition, chloroform produces marked changes in the metabolism of the organism. Indeed,

[1] Cushny, Arthur R. A Text-Book of Pharmacology and Therapeutics (6th ed.). Philadelphia and New York, 1915.

fatty infiltration of various organs, more especially the liver, heart, and kidneys, is produced by the repeated administration of chloroform and even in some cases by a single inhalation. Chloroform possesses some advantages over ether in that it causes less irritation in the air passages, induces the anesthesia sooner, and is noninflammable.

Nitrous Oxide. When administered mixed with air, nitrous oxide may be used for light anesthesia of short duration. Such use, however, carries with it a certain degree of anoxemia, as nitrous oxide does not support combustion in the animal body. If the administration is to be prolonged over a period longer than a few minutes, the gas is used mixed with oxygen. Such a combination may be employed for prolonged surgical operations, but even when mixed with oxygen its use invariably carries with it a degree of anoxemia.

The lack of irritant effects on the air passages makes nitrous oxide-oxygen the anesthetic of choice in cases with infections of the respiratory tract. The return of consciousness is almost immediate and the disagreeable symptoms of nausea and vomiting during recovery, if present at all, are of brief duration. A complete muscular relaxation is not attained by this anesthetic, so it is peculiarly unsuitable for operations requiring exploration of the abdominal cavity. To promote muscular relaxation, its use is often supplemented by local or regional infiltration with novocaine. The asphyxia attending nitrous oxide anesthesia may cause an elevation of blood pressure — a dangerous incident in elderly people. The anoxemia is particularly hazardous in patients with cardiac complications.

Ethyl Chloride. Ethyl chloride is occasionally used

as an anesthetic for minor operations. It acts very quickly and recovery from its effects is almost immediate. In spite of the fact that a number of fatalities have occurred during its administration, the ease with which it may be given continues to lead to its employment in certain minor procedures, such as tooth extraction. Its use is not to be recommended.

Ethylene. Since its introduction, ethylene administered in combination with oxygen has rapidly found favor as a general anesthetic. As the concentration necessary to produce anesthesia is less than that of nitrous oxide, its administration is attended with a considerably less degree of anoxemia than that of the former. It also affords greater muscular relaxation. The recovery is rapid and usually attended with only a slight degree of nausea and vomiting. The one serious drawback which may prevent its supplanting nitrous oxide is the high degree of explosiveness of an ethylene-oxygen mixture. Explosions have occurred with resulting fatalities following ignition from a cautery or a spark of static electricity. The use of ethylene, therefore, is possible only when great care is taken to avoid all possible sources of ignition. This includes not only the actual cautery but electrical sparks produced by lights being turned off or on, by the brushes of an electric ventilating fan, or by static discharge between objects in the room. The machine and the patient must be grounded to prevent this latter occurrence. When the proper safeguards are taken, the administration of ethylene would appear to be relatively safe, but many institutions still refuse to accept the responsibility for its use.

C. *Local Anesthetics*

Local anesthetics may be applied regionally by blocking the sensory nerves supplying the operative field, or locally by direct infiltration of the tissues. On mucous surfaces certain drugs produce anesthesia by direct absorption.

Cocaine. When applied in sufficient concentration, cocaine induces anesthesia or insensibility to pain and touch in any of the mucous membranes — pharynx, bronchi, eye, and urethra. Hypodermic injection is needed to produce anesthesia in regions covered by unbroken skin. Injected into the neighborhood of the nerve trunk, cocaine induces anesthesia of the regions supplied by the nerve. At the present time, the use of cocaine in nerve blocking and in infiltrational anesthesia has largely been supplanted by the introduction of less toxic drugs. It is still employed, however, in operations on the nose and throat and on the eye because of its ability to produce anesthesia by direct absorption from surface application. Acute cocaine poisoning is not infrequent as a result of the administration of too large a quantity of the drug. The dosage employed must always be computed in terms of the crystalline substance as the amount used will vary with the strength of the solution. The adult dose as given in the United States Pharmacopoeia is 0.03 G. (one-half grain).

A second danger to be guarded against in the use of cocaine is the habit-forming tendency of this drug. This tendency is most apt to appear when the patient is subjected to procedures which require frequent repe-

tition of the use of cocaine. An instance may be found in repeated endoscopies for therapeutic purposes.

Novocaine. Novocaine is about one third as poisonous as cocaine, and although its anesthetic action is less powerful, it is adequate for the common surgical procedures. Large doses, as with cocaine, may produce signs of collapse with quickened respiration, vomiting, increased nervousness, fainting, and collapse. The use of adrenaline in the solutions employed to induce local anesthesia delays the rate of absorption and not only prolongs the anesthesia but renders toxic symptoms from the rapid absorption of the drug less liable.

D. *Spinal Anesthesia*

The introduction of novocaine or procaine into the subdural space by means of a lumbar puncture will produce anesthesia in the lower part of the trunk and legs. Formerly, dangerous symptoms were at times encountered from an ascending paralysis involving the respiratory muscles. The administration, further, was not infrequently followed by fainting and collapse, resulting chiefly from the rapid absorption of the drug. These two drawbacks have been largely eliminated by the use of a solution which has a lower specific gravity than that of the spinal fluid and by the admixture of ephedrine to prolong the rate of absorption. A fall in blood pressure is usually observed even with the improved solutions. Immediately after the introduction of the drug the patient is placed in the Trendelenberg position so that the spinal canal forms an angle of approximately 5° with the horizontal. This keeps the solution in the lower portions of the canal. The level

of anesthesia may be altered by adjusting the angle at which the patient is placed.

E. *Syncope in Anesthesia*

Overdosage. If the anesthesia is carried beyond a certain point with ether or chloroform, the respiration becomes shallower and finally ceases while the heart continues to beat. It is probable that the majority of fatalities under ether are of this character. If artificial respiration be commenced at once, the patient can nearly always be resuscitated, provided dilatation of the heart does not occur from the accompanying asphyxiation.

Cardiac Syncope. Cardiac syncope occurs chiefly in chloroform anesthesia and the greater part of the fatalities under this anesthesia are due to such an accident. The pulse suddenly disappears, the pupils dilate, and a death-like pallor supervenes. The breathing becomes deep and labored and ceases. This type of death has been attributed to the onset of ventricular fibrillation, which is usually fatal. Sudden circulatory failure of this type under ether is a very rare occurrence.

Sudden death occasionally occurs on the operating table with nitrous oxide anesthesia in patients with weakened hearts, particularly in the case of patients in whom the cardiac muscle has been damaged by long-standing toxemia from thyroid disease. It is probable that the anoxemia accompanying this form of anesthesia is at least partly responsible for this type of death.

Acute pulmonary edema may occur as a result of violent struggling during induction in a patient with a weakened cardiac muscle. The Trendelenberg position, which may well increase the pressure in the right

auricle, favors the occurrence of such a catastrophe and is to be avoided in this class of patients.

Respiratory Failure. A sudden failure of respiration may occur in patients who have shown a drop in blood pressure during the anesthesia. This has been most frequently seen in elderly individuals with hypertension and arteriosclerosis. It is possible that an anemia of the central nervous system from this fall in blood pressure may be reflected in the failure of the respiratory center.

Status Lymphaticus. Sudden death under anesthesia occurs in status lymphaticus and, in such instances, is usually associated with an enlarged or persistent thymus. The occurrence of this type of fatality seems to have been materially lessened in certain hospitals by a routine X-ray examination of the chest before the administration of an anesthetic to patients under twelve years of age. If an enlarged thymus gland is discovered, X-ray therapy is employed to reduce its size before the operation is performed.

F. *Dangers of General Anesthetics*

The dangers of general anesthetics are by no means limited to the direct action of the drug administered. Foreign bodies, such as false teeth, may be drawn into the air passages with fatal results. During induction of the anesthetic or later during the stages of recovery, vomited matter may be inhaled and lead to obstruction or subsequent lung abscess. In many clinics it is the accepted procedure to place the patient in pronounced Sim's posture on the truck when he is removed from the operating table. This posture is also maintained in bed until recovery to consciousness is complete. A

general anesthetic is avoided if possible in patients where vomiting is frequent, as in cases of intestinal obstruction.

Accumulation of saliva and nasopharyngeal mucus not only obstructs the airway during the anesthetic but drenches the entire bronchial tree with bacteria-laden secretions. This dissemination of infected material plays a part in postoperative pneumonitis and may be partially controlled by the routine administration of atropine before an anesthetic.

The loss of body heat during general anesthesia is great and is to be avoided, both during and after the operation, by the liberal use of warm blankets and other artificial means of applying heat. Hot-water bottles and electric pads, if used at all, are to be employed with extreme caution on an unconscious patient because of the danger of serious damage from burns.

Stimulation of respiration by the direct action of the anesthetic or by excitement during induction leads at times to a reduction of the carbon dioxide content of the blood (acapnia). It has been suggested that occasional fatalities under ether may result from the deleterious action of alkalosis on the heart. The inhalation of carbon dioxide during the anesthesia by direct admixture with the gaseous types of anesthetics or merely by employing rebreathing restores the carbon dioxide which has been "blown off."

G. *Conditions Demanding Especial Consideration in the Choice and Administration of an Anesthetic*

Cardiac Complications. If the anesthetic is properly administered so that anoxemia, strangling, and vomiting do not occur, it is probable that little if any burden

is imposed upon the heart.[2,3,4] Cardiologists agree that "for the purposes of anesthesia and operation, a heart that is damaged but that is carrying on adequate circulation under normal conditions of life is the equivalent of a normal heart." In other words, in evaluating the ability of the heart to carry on an adequate circulation during an anesthetic and operation, it is the functional capacity of the organ during the normal daily life of the patient which is to be considered, rather than cardiac enlargement or any murmurs which may be heard on auscultation. If the patient is accustomed to leading a life involving moderate activity and has been without symptoms, it may be safely assumed that the heart will behave properly during anesthesia and operation. Three types of heart disease form notable exceptions to these statements: syphilitic heart disease with aortic insufficiency, complete block, and angina pectoris are apt to lead to sudden death even with the patient at rest.

If the patient gives a history which indicates early heart failure of the congestive type, treatment with rest, digitalis and diuretics will result in materially lowering the operative risk. In such patients the presence of *râles* at the lung bases may be the only evidence which indicates a low margin of cardiac reserve. When an emergency operation must be performed on patients with a high degree of heart failure, a large dose of a digitalis preparation may be administered intravenously before or during the operation and the treatment continued until the patient is thoroughly under the influence of the drug. The routine preoperative adminis-

[2] Marvin, H. M. *N. E. Jour. of Med.* **199**: 547, 1928.
[3] Phelps, Alfred E. *Jour. Am. Med. Assoc.* **86**: 1824, 1926.
[4] Smith, George Gilbert. *Ibid.* **89**: 925, 1927.

tration of digitalis to patients with normal cardiac function is not justifiable. The drug not only will do no good, but may actually produce harmful effects.

In choosing an anesthetic for a patient who has even slight heart failure, it is important as a general consideration to avoid one which is accompanied by a relatively long period of induction, strangling, rise of blood pressure, or the production of mucus in the air passages. For this reason, nitrous oxide and ethylene are more satisfactory than ether, and ethylene is better than nitrous oxide in that its use entails a lesser degree of anoxemia. The administration must be carried out in a skillful manner, and in such cases it is as important to use care in choosing the anesthetist as it is in choosing the anesthetic.

Pulmonary Tuberculosis. There are at least two ways in which a tuberculous lung may be unfavorably affected by inhalation anesthesia.[5] The first and most obvious way is through inflammatory changes directly provoked by the irritant action of the anesthetic. The fear of this complication has led to the avoidance of ether in pulmonary tuberculosis when possible. A second form of damage which may be of even more serious import is brought about through the increased rate and depth of respiration which is apt to occur in anesthesia. This increased respiratory excursion, at times associated with violent coughing, breaks down the connective tissue barriers of the disease and leads to its extension or dissemination throughout the lungs. Any degree of asphyxiation or rebreathing which promotes vigorous respiratory movements is therefore undesirable. It is in this way that nitrous oxide, and to a lesser degree

[5] Eastman, Joseph R. *Am. Rev. Tub.* 9: 276, 1924.

ethylene, are apt to cause damage. The use of local anesthesia is therefore indicated in the tuberculous patient. If supplementary general anesthesia is needed, either because of the nature of the operation or in order to avoid the emotional strain in an apprehensive patient, it is to be administered with due regard to its effect as a respiratory stimulant. Ethylene or nitrous oxide are usually employed, although some anesthetists prefer a light ether given with the open cone method.

Diabetes Mellitus. As ether anesthesia may be attended by an increase in the amount of sugar in the blood, its use is to be avoided in patients suffering from diabetes. Nitrous oxide-oxygen or ethylene serve as satisfactory general anesthetics, but when technically possible most surgeons prefer to work with local anesthesia. Spinal anesthesia is particularly adapted to the operations on the extremities which are so frequently found necessary in the complications of the disease. The proper preparation of a diabetic patient for anesthesia and operation is dealt with more fully elsewhere.

Acute and Chronic Respiratory Infection. In instances where the respiratory tract is the site of an inflammatory process, either acute or chronic, it is advisable if possible to avoid the use of inhalation anesthesia. The increased respiratory excursion, combined with the increased secretion of mucus which may attend its use, very often serves to disseminate the process more widely throughout the lungs. The use of ether may be particularly deleterious due to added irritation of the mucous membranes. Local or regional block anesthesia will be found less harmful, but even with their use an exacerbation of the pulmonary symptoms not infrequently follows. Operations, except those of the gravest emergency, are

to be avoided in the presence of a respiratory infection.

Shock. Ether definitely lowers the tone of the vascular system and predisposes to surgical shock or aggravates the condition if it is already present. It is also to be borne in mind that spinal anesthesia or the use of large quantities of novocaine in the tissues may be attended by a further reduction of blood pressure. For such procedures as cannot be suitably delayed until the symptoms of shock have been recovered from, it is probable that nitrous oxide-oxygen or ethylene are the anesthetics of choice.

Debility and Anemia. It is particularly desirable to avoid the profound depressant action of deep surgical anesthesia in patients with debility or the severer grades of anemia. If ether is necessary to provide adequate muscular relaxation it should be supplemented by local infiltration and administered by the open cone method in the smallest possible dosage. Frequently the abdomen may be opened and closed under local anesthesia and the period of administration of the general anesthetic confined to the briefer interval in which intra-abdominal manipulations are necessary. As ether is attended by less anoxemia than the other forms of inhalation anesthesia, its use is often the safest in this type of case. The ether vapor may oftentimes be enriched by oxygen to advantage. A patient with a severe degree of anemia requires a surprisingly light dosage of ether to maintain surgical anesthesia.

Thyroid Disease. Several features complicate the course of anesthesia in thyroid surgery.[6] The state of nervous irritability which occurs as a result of thyroid toxemia demands that the patient be saved all un-

[6] Sise, Lincoln F. *Anesthesia and Analgesia.* 4: 287, 1925.

necessary psychic or physical strain. A typical thyroid crisis with high temperature and even fatal outcome may be produced merely by a sudden mental shock. For this reason, the careful psychic preparation of the patient is of the utmost importance. In a perfectly organized clinic this may be carried out to an extraordinary degree of perfection. The anesthetist visits the patient on the day previous to the operation in order to secure his confidence and allay his apprehensions concerning the anesthesia. The anesthetic may even be induced in the patient's room if the patient is very toxic. In any event, the transference of the patient from his room to the operating room and operating table is to be accomplished with the utmost speed and lack of disturbing factors. Delays and other results of inefficient organization are to be avoided. The anesthetic itself must be one which produces as little effect as possible on the patient's nervous equilibrium, both during the administration and recovery.

A second feature complicating thyroid disease is the frequency of cardiac complications. The most skilled anesthetist may be confronted with sudden death on the table in the case of a patient with whom everything had appeared to progress smoothly up to that point. This catastrophe is particularly apt to occur to patients whose hearts have been subjected to the strain of toxemia over a period of years. Restorative measures are usually ineffective, but in an attempt to reduce the incidence of this accident particular care is to be taken to avoid anoxemia.

Respiratory obstruction may exist before operation due to the pressure of a thyroid tumor on the trachea. If it is severe, the administration of an inhalation an-

esthetic is contra-indicated. At times tracheotomy has been found necessary to provide an adequate airway, following collapse of the trachea after the removal of a large growth. The convalescence of thyroid patients is frequently complicated by symptoms of tracheal irritation. This may arise from the exposure and manipulation of the trachea during the operation. Any factors which tend to increase this irritation and lead to the increased formation of mucus aggravate this condition.

Injury to the recurrent laryngeal nerve is not infrequent in thyroid surgery, arising either from direct injury or from pressure due to edema. If the injury is bilateral, the serious consequences of paralysis of the vocal cords may supervene.

If these governing features of thyroid surgery are kept in mind, intelligent choice of the anesthetic for any given case is possible. In general, ethylene-oxygen most nearly approaches the ideal anesthetic for toxic patients not presenting symptoms of respiratory obstruction. Cases with little or no toxicity and without signs of obvious cardiac damage may be operated on with nitrous oxide-oxygen unless undue cyanosis attends its administration. In cases with respiratory obstruction, novocaine is the anesthetic of choice. Local anesthesia is all that is needed in small tumors of the nontoxic variety. In general anesthesia particular attention is to be devoted to affording the patient an adequate supply of oxygen.

Vomiting. Inhalation anesthesia is to be avoided when possible in patients who present the symptom of frequent vomiting before an operation. Such cases occur most notably with intestinal obstruction from any cause. If local infiltration or regional block anes-

thesia proves inadequate and recourse must be had to a supplementary general anesthesia, this should be administered with the patient's head placed on one side and with an easily removable cone or mask to avoid the disastrous effects of aspiration of vomited material. The use of the stomach tube may further lessen the danger of this complication.

III. Traumatic and Industrial Surgery

That branch of surgery which has made most progress with the premeditated use of the possibilities of preventive medicine has been industrial surgery. There is perhaps as much need for progress in this line as in any other, as the number of industrial accidents is startling. About 22,000 fatal accidents and 250,000 serious accidents occur yearly. There has been a steady improvement in the accident rate of various industries but there is still great room for improvement. The most dangerous occupation is mining, followed closely by the fisheries and by the electrical industries.

One of the most important factors in the prevention of accidents is the sizing up of the man himself, to keep him out of an occupation too dangerous for him to care for himself properly. Thus Bloedorn [7] found that 8 per cent of the total number of men injured received over 26 per cent of the total number of injuries, obviously striking evidence of lack of individual fitness for their jobs. Some of the most obvious causes of accidents are impaired senses, such as hearing or vision, intemperance, ignorance, sickness, and fatigue. All of these are obviously quite readily controllable by the use of proper

[7] Bloedorn, W. A. *U. S. Nav. Med. Bull.* **10**: 585, 1916.

preventive measures, particularly supervision of the physical and mental condition of the employees.

A second important line of attack is the provision of safety appliances and proper working conditions with regard to lighting, space, and the like. However, there are invariably a striking number of accidents which occur apparently for no explicable reason. Human nature is so constituted that a person requires a distinct and forceful stimulus to do even that which he knows he should do. The workmen's compensation laws have been perhaps the greatest single aid in the establishing of safety devices and the application of preventive measures to industry, because when an employee costs money much better care is taken of him than otherwise. The prevention of fire and other disasters is almost too obvious to mention, but even so there are not a few of us who can still remember vividly the Triangle Waist Factory fire and other similar ones on a smaller scale.

Closely allied with the prevention of accidents is the prevention of undue loss of time from those accidents which do occur, or from disease, particularly sepsis. Here again the methods of attack are obvious: first, proper equipment of all large industrial plants with surgical facilities with first-aid packets always available; second, instruction of the workers in standardized first-aid methods. Unfortunately, the efforts of workers to help their fellows sometimes are not directed with particular intelligence, and many do more harm than good. This is particularly true of attempts to take foreign bodies out of the eye, and similar procedures. The great factor causing unduly prolonged convalescence is sepsis. Without the prevention of sepsis much of the more skilled work of the surgeon would be valueless.

Skilled surgical care should be available in or near the works and provision made for systematic aftercare as well as immediate treatment of even slight injuries.

The third field of preventive measures is preventing permanent disability or at least keeping it to a minimum. This requires, first, proper supervision during convalescence, with the aid of those especially trained in this type of work, and afterwards the use of any measures, such as physiotherapy, that may be of value. One great advance could be made with relative ease if all surgeons could be trained to perform amputations with some regard to the functions of the part on which they are working, rather than with regard only to the exigencies of the injury; so that the stump may give the greatest service to the individual.

When we come to the prevention of disease in industry — a field a little apart from the surgeon but nevertheless an important part of the work of the industrial physician — there are a number of types of improvement possible, such as so-called health insurance. This now usually distributes the risk among a group of persons, but it should include a system of improvement and extension of the present factors for the prevention of disease. The importance of fatigue [8] as an etiological factor in accident and disease must be recognized in every occupation, and an effort made to keep it down so far as is compatible with the proper discharge of their duties by the employees.

[8] Spaeth, R. A. *Jour. Ind. Hyg.* 1: 435, 1920.

IV. Infectious Diseases

A. *Tetanus*

Tetanus is fortunately a rare disease. The organism has little invasive power, and owing to the fact that it grows only under anaërobic conditions, it demands exceptionally favorable surroundings. While the spores are fairly widespread in nature, a few spores introduced into the body free from toxin may fail to cause disease because they are readily taken care of by the protective agencies of the body. The most important protective measures are the generalized use of tetanus antitoxin as a prophylactic measure in all serious punctured or lacerated wounds, and also prompt and extensive *débridement* of ragged and lacerated wounds.

B. *Gas Bacillus and other Related Forms of Wound Infection*

The presence of anaërobic bacilli in wounds can always be traced to direct or indirect infection of the wound from soil contaminated by feces. Many of the organisms are normal inhabitants of the intestinal tract of men and animals and are present in great numbers in cultivated ground. The most important members of this group are the Bacillus welchii, vibrion septique, Bacillus oedematiens, and Bacillus histolyticus. In all wounds the chief aim should be the prevention or limitation of infection. To this end foreign material and devitalized tissues should be removed, the procedure commonly known as *débridement*. At the same time, bacteriological control by repeated smears and cultures should be instituted. Primary suture should be avoided

for at least six days, or until the infection is under control. It is possible that serological treatment may be of some value, a mixed antitoxin being employed against the various organisms. Always tetanus antitoxins should be administered.

C. *Pyogenic Infections*

In the prevention of the pyogenic infections the most important factor is the proper care of minor injuries to avoid infection. This comprises the cleaning out of any foreign material, thorough washing of the part, the application of nonirritant antiseptic solutions, and proper drainage to protect the injury from contamination. The danger of fatigue or illness lowering resistance to the pyogenic organisms is obvious, and may readily be guarded against. Careful preparation of the operative field in surgical cases is essential to prevent infection of the incision.

V. Metabolic Diseases

One of the most important metabolic diseases, from the standpoint of preventive surgery, is diabetes. With the advance in our knowledge of dietary treatment, and with the use of insulin, deaths from diabetes, as such, have become very rare. A recent series,[9] studied at the New England Deaconess Hospital, indicated that at the present time practically three fourths of the deaths of diabetic individuals are due to surgical complications.

In diabetes, perhaps more than in any other disease, close coöperation between the internist, the surgeon, and the laboratory man is absolutely essential to the well-being of the patient. Not only the immediate emergency

[9] Root, H. F. and Warren, S. *Boston Med. and Surg. Jour.* **196**: 864, 1927.

must be considered, but the underlying condition of the patient as well.

Generous use of the laboratory is absolutely essential because even the keenest of trained clinical observers are unable to say whether sweat is from sepsis or from an overdose of insulin, and this is a question that the laboratory can answer in twenty minutes. While probably the surgeon is perfectly competent to act as doctor, as well as surgeon, for his patient, he has not the time to make detailed physical examinations, arrange for laboratory tests, calculate the diet, and prescribe the ever-varying doses of insulin. For the surgeon to enter into such detail is really a waste of his professional capital. It is far better for both surgeon and patient to have the medical care of the diabetic handled by a medical man.

One of the most important aspects of surgery in diabetes is the relation of foci of infection to sugar tolerance. Thus latent gallstones, or an unsuspected appendicitis will often lower the carbohydrate tolerance to a striking degree, and often do serious injury to the general condition of the patient. Surgery is urgently required to correct these conditions.

Surgery of diabetes, as in no other condition, is a surgery of prevention: prevention of sepsis; prevention of gangrene; prevention of acidosis and coma.

VI. The Neoplastic Diseases

While we are ignorant of the etiology of the various malignant diseases we know certain factors that have to do with predisposition toward their occurrence. Thus we have to recognize the tendency of chronic irritation, and to realize that it is essential to remove any source

of chronic irritation before more serious changes occur. In the second place, we have come to recognize that certain chemical irritants, such as aniline and other coal-tar products, have a tendency to predispose to certain types of malignant disease, and therefore, that exposure of workers to these substances should be reduced to a minimum. On the basis of the chronic irritation theory papillomatous growths other than common infectious warts should be removed. Pigmented moles should be removed when they occur in regions subject to irritation and certainly they should be removed if there is any evidence of growth or ulceration. Chronic ulcers of all types should be watched to make sure that malignant changes do not develop in them, particularly at their margins. The keratoses demand attention, and excision or radiation is essential as a preventive of the development of a skin cancer. One of the most important precancerous conditions of the mouth is leukoplakia, which should never be allowed to persist untreated.

Another field of preventive medicine is that concerning the early diagnosis and treatment of malignant lesions in order to allow institution of effective therapeutic measures. The safest rule to follow is that anything resembling cancer should be treated as such unless definitely proved not to be cancer.

The prevention of X-ray and radium burns in either doctor or patient seems so obvious as to need little comment, but from time to time accidents occur which illustrate the importance of education as to the many dangers inherent in radiation therapy. Practical experience is virtually the only safeguard.

X

PEDIATRICS

Pediatrics, perhaps more than any other specialty, has laid emphasis on the prevention as well as the treatment of disease. There are two groups of problems, more or less interlocking, that must be considered in any program stressing the preventive aspects of pediatrics. The first of these is the medical supervision of the well child; the second, those preventive measures immediately related to the diseases of children. The field is so large that perhaps it can be most easily organized from the standpoint of time.

I. Diseases of the Newborn

The first group to consider — the disorders of the newborn, with the exception of syphilis — does not present any great opportunity for preventive medicine. Asphyxia and atelectasis are both more or less dependent on the circumstances prevailing at the time of labor, and through proper obstetrical procedure should be reduced to a minimum. Another type of injury associated with delivery is that of intracranial hemorrhage. This lesion is frequently due to the use of undue force in delivery, particularly in version or in difficult labor, and is especially common in cases where there is disproportion between the head and the pelvic outlet. At the same time the importance of safeguarding against the so-called obstetrical or brachial paralysis can be brought out. One group of hemorrhagic conditions in the newborn is readily controlled by the intravenous

injection of a small amount of compatible whole blood.

Infections of the skin and cord are particularly dangerous and troublesome in the newborn. Fortunately, preventive measures are easily instituted. Some of the most important of these are proper care of the cord after delivery to insure against infection; protection of the skin from infectious matter of all sorts, including pyogenic infections of the hands of the nurse; and the prevention of chafing or irritation of the skin which is liable to occur through the use of insufficiently washed or rinsed diapers.

One of the most brilliant achievements of preventive medicine is the prevention of ophthalmia neonatorum [1] by the method introduced by Credé, namely the instillation of a 1 per cent or 2 per cent silver nitrate solution into the conjunctival sacs of newborn infants. This is so sure a preventive of ophthalmia neonatorum, and the danger of gonorrheal infection is so general, that there is no excuse in any case for the neglecting of this vitally important protective measure.

II. Nutrition

The whole field of nutrition is really within the bounds of preventive medicine. There is no need here to go into the details of proper feeding of infants and children, but it is well to emphasize that in most cases breast feeding is the ideal food for infants; that the diet should be balanced, should meet the caloric requirements of the infants, and should, particularly, contain ample quantities of the accessory food factors. These various accessory food factors may be considered severally in relation to the individual diseases with which they are concerned,

[1] Kreitmair, H. and Moll, T. *Münch. med. Wchnschr.* **75**: 637, 1928.

such as scurvy and rickets. The possible danger of vitamin imbalance should not be overlooked.

The most valuable and most obvious means of prevention of nutritional disorders is breast feeding. The breast-fed child needs no formulae, no pasteurization or modification of its milk, runs virtually no danger of getting an infected product. Furthermore, together with the milk is conveyed a certain amount of immunity to the communicable diseases, particularly diphtheria. If, however, artificial feeding must be resorted to, great care must be taken to insure a supply of clean milk of a proper fat and solid content. Clean milk [2] demands not only careful handling and preparation of the formula in the home, but consideration for the vicissitudes of the milk from the time it leaves the cow. Only certified or Grade A milk should be used. The question as to whether raw or pasteurized or boiled milk should be used is one that is very difficult to decide. However, experience has shown that even with the best of raw milk there is danger from infection, and with properly pasteurized milk there is none.

With the extension of our knowledge of vitamins and their importance in the diet it has become necessary for pediatricians to be sure that the prescribed diet contains an ample supply of the various accessory food factors. Thus, in order to offset scorbutus a liberal amount of orange juice should be added to the diet daily. For the prevention of xeropthalmia it is necessary that there be an adequate supply of vitamin A which may be supplied by the milk fats or cod-liver oil. Severe rickets is a rare disease; the milder forms of the disease are very com-

[2] Rosenau, M. J. Preventive Medicine and Hygiene (5th ed.), p. 695. New York, 1927.

mon, however. Cod-liver oil should be added to the diet, and the infant kept out of doors in the sunlight an appreciable portion of the time.

III. Infectious Diseases

A. *Diseases of the Respiratory System*

From these two groups of disorders we pass to the infectious diseases, particularly those involving the respiratory system. Most important in view of frequency is the common cold. From the point of view of severity broncho-pneumonia is the most important. In the control of respiratory disorders our knowledge is relatively meager; however, at the present time we can first lay stress on the maintenance of a moist atmosphere and an even temperature in the house. Secondly, contact with infected adults must be avoided, as this is one of the most prolific sources of respiratory diseases. In older children if there are repeated colds the daily routine should be studied to see whether it could give rise to chronic fatigue, which often manifests itself through lower resistance to respiratory disease. At times frequent colds indicate enlarged and diseased adenoids or tonsils which act as a nidus of infection.

B. *Diseases of the Circulatory System*

In considering the diseases of the circulatory system those infections which predispose to cardiac damage are of especial importance, and most important among these are the so-called rheumatic group; rheumatic fever, chorea, and tonsillitis, as well as other members of the streptococcus group, such as scarlet fever. Emphasis should be laid on prolonged rest in bed following

any one of these diseases and the prompt removal of any focus of infection, such as tonsils may prove to be, should be insisted on in this type of case.

C. *Diseases of the Genito-urinary System*

In considering the diseases of the genito-urinary system there are three of particular importance. The first is nephritis. Unfortunately, we are rather ignorant of the etiology, but we do know that it is particularly liable to occur in the wake of tonsillitis and scarlet fever. This last disease is of the greatest importance. Careful regulation of the diet and rest in bed are of definite value in the prevention of nephritis after these diseases. Probably one of the most common lesions of the kidney in younger children is pyelitis. The etiology of this condition is not always obvious, but there are many cases in which, apparently, chronic constipation is a predisposing cause, and as the infecting agent is usually the colon bacillus this makes constipation all the more likely a cause. Regulation of the bowels should hardly be necessary to touch upon, but carelessness in this regard is very common among children unless there has been careful supervision and training by the parents. In institutions, outbreaks of gonorrheal vaginitis in young girls form a serious menace to health. These can be controlled by care and cleanliness in caring for the children. For the protection of those children under the charge of nursemaids, if there is any reason to be suspicious of the health of the nurse examinations should be made by a competent physician to rule out the possibility of gonorrheal infection.

D. *Middle Ear Infections*

There is a miscellaneous group of infections for which a good deal can be done with our present knowledge in the way of prevention, perhaps not so much in reducing the frequency of the diseases as in preventing serious consequences from them. One of the commonest and most important of these diseases is otitis media. Enlarged adenoids with resultant interference with the eustachian tubes are one of the most common causes of this disorder. Adenoids, in addition, cause many other types of trouble such as mouth breathing, susceptibility to respiratory infections, and the like, so that they should be removed promptly. Drainage of otitis media is absolutely necessary. An eardrum punctured too soon does not cause any trouble, but an eardrum punctured too late may already have held the pus so long that mastoiditis, or even brain abscess, may develop. In this connection it is well to remember that mastoid cells are not developed in very young children.

E. *Contagious Diseases*

The commonest and most time-honored preventive procedure in pediatrics is vaccination against smallpox. Smallpox has fortunately become so rare a disease that we are in danger of disregarding the means of protection against it. The vaccination of every child against smallpox should be urged on parents.

Diphtheria exists only through the tolerance of the population. We have adequate means for its extermination. Since in young children there are but few immunes, it is hardly worth while to Schick-test them; but instead univeral use of toxin anti-toxin is suggested in

those under six years of age. So far most efforts in the diphtheria prevention program have been concentrated on the school children and they are rather better protected than others. In children of pre-school years there is still relatively little done and it is here that the work of the pediatricians is particularly important. Of course the detection of carriers and of mild cases of the disease is of great importance in attempting to wipe out possible sources of its spread.

In the case of scarlet fever our knowledge has not been as thoroughly organized as in the case of diphtheria. However, the Dick test is apparently satisfactory for detecting susceptible individuals. Of course in all the communicable diseases it is hardly necessary to stress the importance of quarantine and isolation. It is important to remember that scarlet fever is highly contagious before the rash has appeared, and at times when the disease is prevalent it is necessary to be suspicious of every upper respiratory infection. The prevention of scarlet fever is particularly important in order to prevent disability not only from the disease itself but from the long train of complaints which frequently follow in its wake.

Measles is a very important disease in that its mortality is extremely high in children under three years of age, and consequently every effort should be made to protect the younger children from it. The attitude of most parents — that their children might as well have measles and get it over with — is perhaps not too much to be criticized in the case of older children and in the case of strong children. But in those under three years of age and in those in poor health it is an ex-

tremely dangerous procedure. Convalescent serum [3] is of considerable value as a means of providing temporary immunity. Unfortunately it is seldom available in sufficient supply to immunize all exposed individuals, and it should be used particularly to protect the youngest children and those in poor physical condition. In the control of hospital epidemics convalescent serum is extremely useful.

Pertussis is still a disease concerning which we know relatively little. The vaccine derived from the Bordet-Gengou bacillus is apparently of some value in conferring immunity, although workers differ on this point. Its usefulness in treatment is extremely doubtful.

Epidemic cerebrospinal meningitis is a transmissible disease which so far can be handled only on the basis of rigid quarantine of known cases and the obtaining of repeated negative cultures before releasing infected individuals or carriers; in any case of the disease every effort should be made to detect the source from which it was contracted in order that further spread may be prevented. One of the most dangerous sequelae of cerebrospinal meningitis is hydrocephalus. Fortunately, with the use of adequate amounts of anti-meningococcus serum, particularly if introduced through ventricular puncture as well as intra-spinally, the likelihood of occurrence of this complication may be greatly reduced.

F. *Tuberculosis*

Tuberculosis presents a very serious problem in infancy and childhood. The type of infection of chief importance is that due to the human bacillus. Formerly

[3] Park, W. H. and Freeman, R. G., Jr. *Jour. Am. Med. Assoc.* 87:556, 1926.

a good deal of importance was given to infection of the bovine type and later it was almost entirely disregarded. However, at the present time there is beginning to be a swing backward toward the importance of this type of bacillus, and there is not a little evidence that infections due to the bovine type are of very definite importance.

Milk is one of the important sources of tuberculous infection, both of the bovine and of the human type. Of course, it is virtually the only source of infection with the bovine type. Pasteurization of milk completely removes any danger of milk-borne infection with the tubercle bacilli, and thorough pasteurization should be insisted on. Certified milk probably can be kept entirely free from contamination with tuberculosis but its cost is prohibitive for large-scale production and pasteurized milk assures us of a safe and reasonably priced supply.

One of the most interesting developments in the prevention of tuberculosis at the present time is the method of active immunization introduced in France by Calmette,[4] in which small amounts of avirulent bacilli are given to infants by mouth, producing apparently a very satisfactory degree of immunity. As yet this method has not been widely tried, but apparently later experiments are not yielding as good results as earlier ones.

The need of protection of children from persons with active tuberculosis is obvious. The infant creeping on the floor and putting things into his mouth, the younger children with unwashed hands, have every opportunity of ingesting any bacilli that may be in their vicinity. Consequently, it is extremely dangerous for children to be associated with individuals with active tubercu-

[4] Calmette, A. and Guérin, C. *Ann. de l'Inst. Past.* **38**: 371, 1924.

losis, even though the infected individuals may have learned how to protect others fairly satisfactorily.

G. *Syphilis*

Another disease of very great importance is congenital syphilis. In this disease prevention lies in the hands of the obstetrician rather than the pediatrician. There is no excuse for the continued occurrence of congenital syphilis with the methods of treatment of the disease at present available. The mother should be actively treated during pregnancy, even if she has the disease only in a latent form. In untreated cases the prognosis is extremely bad, as the percentage of still births is fairly high in syphilitic mothers and there is practically no possibility for the child to escape inherited syphilis. Fortunately, if any of the minor symptoms of syphilis appear in an infant, active anti-syphilitic treatment will serve to prevent more serious complications later on.

H. *Typhoid Fever*

Finally, for the sake of completeness, typhoid fever should be mentioned in connection with the infectious diseases. Although the disease is not now so important as it was a few years ago, it is still very far from being extinct; and it is only by vigilance that our safety is maintained, a fact strikingly brought out by the recent Montreal epidemic. Vaccination, of course, conveys immunity to the disease for about three years. The pasteurization of milk cuts off that avenue of infection. In almost all except rural districts the water supply may be considered as safe.

In every case of typhoid fever there are a number of procedures of great importance in public health, and

preventive aspects that must be considered: first, the problem of isolation of the individual and the proper disposal of the excreta to prevent infection of others; second, the investigation of the sources of infection in every case, and a remedy of the condition found. Detection and control of carriers are essential, particularly of those working in food handling.

IV. Mental Hygiene

There are certain aspects of mental hygiene which are important. First, carrying prevention to its logical terminus, the marriage of individuals having nervous disorders should be discouraged. One of the most important of these disorders is idiopathic familial epilepsy. The parents of the child should be made to understand that a great deal depends on the atmosphere of the home, and that the child brought up in an atmosphere filled with tension and querulousness cannot but show resultant strain on its nervous system.

In connection with mental hygiene should be considered the handling of the feeble-minded or idiot child and his reclaiming so far as possible, and the protection of society from him as he grows older. Of great importance here is the splendid work initiated by the late Dr. Fernald, at Waverley, which can serve as a model for all work of this type.

V. School Hygiene

When the child comes to school years, there are a number of points that should be considered before subjecting him to the rather rigorous ordeal of modern education. First, the sight should be examined for any evidence of myopia or strabismus, and every effort

should be made to correct these defects before subjecting the eyes to the added strain that becomes necessary with reading, writing, and watching the blackboard. If possible myopic children should be grouped in special classes, such as the sight-saving classes now organized in the larger cities, and corrective exercises instituted. Our modern life is so dependent on vision that its impairment is a very serious handicap. The schools through vocational guidance can often aid a pupil with impaired sight to find suitable employment.

A test of hearing may often explain the apparent backwardness of a child in school as due to partial deafness, and by recognition of the condition a material difference can be made not only in the physical but in the mental condition of the child. Indeed, mental hygiene has some bearing in this field inasmuch as an unrecognized sensory handicap may well contribute to the establishment of an inferiority complex.

The hygiene of the school child is a comparatively recent development. Schools are opposed to every physiological activity of the child. He is cooped up during those hours when he needs most to be in the sun and the fresh air; he is forced to bend for hours over books; he is crowded in with other students so that ideal conditions are afforded for the transmission of communicable diseases; his hours for meals are entirely disturbed; at times a short recess is allowed during which he hastily gulps a few mouthfuls which may or may not be wholesome in themselves, but which merely serve to take the edge off his appetite for the meal which he has an opportunity to eat when he finally reaches home.

There have been various attempts made to improve conditions.

The first and most obvious efforts were directed toward the control of communicable diseases in the schools, which were veritable hotbeds of infection, spreading the epidemic diseases of childhood not only among the pupils but among their brothers and sisters not yet of school age. It was to cope with this problem that in the early nineties first in Holland, and then in Boston, medical inspection of the school children was instituted, primarily with a view to detecting and excluding from the schools those children suffering from the communicable diseases. This is still an important phase of the so-called school hygiene.

The next development was along purely mechanical lines, improving first ventilation, then lighting, then general safety from the point of view of fire and panic; next came attention to the individual pupils, the obtaining of the proper height of seat and desk, the institution of corrective gymnastics, and the beginning of the dissemination of the doctrine of fresh air.

Later on, after these more obvious points were more or less adequately cared for, came the problem of compensating for the physical disabilities of different children. Medical inspection was extended to detecting nearsightedness and difficulty in hearing. With the rise in popularity of the doctrine of focal infection there are wholesale inspections of throats, and the enucleation of tonsils if they deviate from normal in the least degree. Still later, such minor points as the degree of nutrition of the children became of importance, and emphasis was laid on fattening the pupils to an assumed standard.

Along with this, there was recognition of the really sick children, those with incipient tuberculosis or with heart disease, and wise and farsighted provision was made for their care: on the one hand, the beginning of open-air classes and instruction in hygiene and nutrition; on the other hand, special care of children with cardiac disability, providing them with various safeguards from exertion. One particularly valuable feature has been the emphasis on vocational training for the children with either sensory impairment or cardiac disability, guiding them into those occupations in which they will be less hampered by their physical handicaps and in which their health will be sufficiently protected without unduly diminishing the amount of productive labor of which they are capable. Perhaps in this connection should be considered child labor and the control of the child in industry. A certain amount of work is excellent discipline and no drawback from the physical standpoint; however, heavy work, long hours, and particularly indoor work should be discouraged.

The modern school building with its elaborate system of ventilating, lighting, and heating, and with its inspection by school physicians and school nurses represents a tremendous advance over the brick schoolhouse of fifty years ago with its staff of one or two teachers. However, when we come to weigh the difference in cost one cannot help wondering whether there is a commensurate difference in results.

VI. Summary

Finally, it is well worth emphasizing that at present 50 per cent of the pediatric practice is devoted (and it is hoped that still more will be in the future) purely to the supervision of the normal child, with particular care of the diet, advice as to hours of work, play, and sleep, and periodic examinations for the detection of early symptoms of disease.

XI

OBSTETRICS

The whole trend of modern obstetrical practice has been to lay more and more emphasis on the prevention of disease, and particularly of those conditions apt to lead to trouble at the time of labor. The course in obstetrics as given at this time suggests, of course, the essentials of the physiology of pregnancy and parturition, and the treatment of the normal conditions and the various emergencies which may arise. However, most stress is laid on the guidance of the pregnancy in its normal course and the prevention of complications, as well as the detection and treatment, at an early period, of those conditions which might give rise to trouble later. It is rather interesting that the obstetricians, so far as the general routine practice in the vicinity of Boston is concerned, are equaled only by the pediatricians in their regard for and emphasis on preventive measures.

There are certain general measures for care during pregnancy which deserve particular importance. In the first place, a complete history is necessary in order to safeguard the patient from any possible danger to which she might be predisposed. In particular, in order so far as possible to protect the sufferer from certain earlier conditions from the added strain of pregnancy, there should be special inquiry into any previous occurrence of rickets, with the consequent danger of bony malformation; of dysmenorrhea, with the possibility of finding an undeveloped condition of the uterus or tuberculosis; of nephritis, or of heart disease. This his-

tory should be supplemented by a complete physical examination to determine what special problems may be presented by the individual patient, and this physical examination should include pelvic mensuration six weeks before the probable date of confinement, in order that any danger of disproportion between the fetus and the pelvic outlet may be guarded against and provided for. The first complete physical examination should be followed by monthly check-ups until about two months before term when fortnightly check-ups should be substituted. They should include, at least, determination of blood pressure and complete urine analysis.

There are certain general matters of advice to be given to the patients, such as diet, exercise, and the like, which should be brought out at the time of the first examination, and which may be briefly summarized as follows. The diet should be one with sufficient roughage to avoid constipation, and with ample mineral and vitamin content; should include an ample amount of water; and the caloric value should be kept at such a point that the patient does not gain appreciably over one pound a month. Exercise in moderation, especially walking, is advisable. The clothing should be kept loose, and if necessary, abdominal support should be provided. The teeth should be put in order by a competent dentist. Often a wash or tooth paste containing milk of magnesia is of advantage. The breasts should be kept clean with soap and water; frequently during the last month the use of cold cream is advisable. Intercourse is permissible up to the seventh month.

There is an excellent opportunity afforded the students to realize the practical importance of these measures and the manner in which they can be carried out

through the time which they spend in the prenatal clinics during their course in obstetrics. Here the students have an opportunity to see at first hand the examination of the patient and the instruction in the measures to be carried out. Through actually seeing the work as it is carried out in these clinics, the students get a very much clearer idea of what is to be done in caring for cases of pregnancy than they can through lectures or through seeing only cases at term.

Together with the general measures there are certain others directed particularly toward the avoidance of certain of the dangers of pregnancy. For example, in regard to avoidance of miscarriage, heavy lifting should be avoided, and falls should be guarded against. It is frequently advisable to take special precautions, even rest in bed in certain cases, at the time of the periods. Finally, it is important to educate the patient that if any blood appears it is absolutely necessary to go to bed and keep quiet. A special hazard in some cases is the presence of syphilis and if this disease is present it should be energetically treated throughout the course of the pregnancy.

Among the measures for avoidance of toxemia probably the most important is the maintenance of an ample intake of water and the avoidance of constipation. In addition frequent examinations of the urine for albumin are of considerable value. There should be prompt investigation of frontal headache, edema of face or hands, blurring of vision, or any rise in blood pressure.

Our knowledge of eclampsia is as yet too scanty to permit us to lay down any definite rules, but apparently the following points are advisable in preventing the onset of this condition; the use of a balanced diet of not

too great caloric value; and the prompt treatment of preëclamptic toxemia by means of forcing fluids and drastic catharsis.

The measures for the avoidance of dystocia are obvious, such as pelvic mensuration before term, examination to detect any disproportion between the head and the pelvis, and examination to determine the type of presentation.

The danger of subtentorial hemorrhage and of obstetrical paralysis through trauma in the course of operative deliveries should be brought to the attention of the student.

Through the present arrangement at the Boston Lying-In Hospital whereby members of the staff of the Children's Hospital examine the infants before they are discharged from the hospital, and recommend any procedures advisable, the student is able to gain an idea of the advantage of following up the cases and of the importance of coöperation between obstetrician and pediatrician to insure successful management of the infants.

Puerperal sepsis is far from a mere chimera. Fortunately this condition is now comparatively rare among trained men in private practice, but there is still room for much improvement, particularly in the rural sections. In some localities an important share of obstetrical cases is handled by midwives or adherents of one or another of the various cults whose ideas of both physiology and bacteriology are extremely hazy. They rely on rule-of-thumb methods, and occasionally bring about conditions that need a Holmes or a Semelweiss for their correction.

Hospital epidemics are still a very real danger. Pro-

phylaxis is simple and should be planned according to the usual methods of asepsis. Aseptic precautions should be carefully followed, whether a normal or an operative delivery is expected. The use of douches should be discouraged. Vaginal examinations should be avoided so far as possible, and completely omitted in any cases where there is a possibility of subsequent Cesarian section. The hospital epidemics are usually coincident with marked prevalence of infectious disease in the community, and, as yet, extreme care in every detail is the only means found to prevent the occurrence of sepsis.

It is important that the students should grasp the idea that the obstetrician's responsibility does not end with delivery, but should include the entire period of the puerperium. It is not enough to see the patient safely through her present pregnancy, but she must be prepared for her normal activities and the possibility of subsequent pregnancies. In this connection should be emphasized the absolute necessity of prolonged rest in bed after delivery, the need for prompt repair of lacerations, and, finally, the great value of a final examination a month to six weeks after delivery, in order to detect and remedy any conditions that may require attention, such as cervical lacerations, malposition of the uterus, or other pathological changes.

An important duty of the obstetrician, of a preventive nature, is the instillation of silver nitrate or other silver preparations into the conjunctival sac of the newborn infant. This is absolutely essential, as its neglect may possibly, even in cases where little suspected, give opportunity for the development of gonorrheal ophthalmia.

XII

PSYCHIATRY

When we leave the field of definite, demonstrable anatomical or physical abnormalities we are somewhat at a loss, particularly in dealing with anything so nebulous as the human mind. The tremendous problem of mental disorders, including not only the true insanities but also the minor mental disorders, is appalling. No one can help but be impressed by the frequency with which he passes the huge state hospitals maintained for those with mental disorders, and few can view with equanimity the enormous burden laid on the productive portion of society by those with mental disorders who nevertheless are physically well enough to live for long periods.

When, in addition to the individuals in institutions, are considered all those who should be in institutions and the potential danger to society which they represent, the magnitude of the problem is even more striking. In considering the problems of insanity, it must be remembered that the insane individual is a menace not only to himself but to the community as well, not so much through the danger of infecting others, as is the case in most diseases, but rather through the danger of injuring others either bodily or by damage to property. In addition, the maintenance of these individuals is a tremendous economic drain on society.

In the field of psychiatry the most crying need is research work, since only a few of the mental diseases are understood from the standpoint of either pathology

or causation. Such common and such important conditions as manic-depressive psychosis and dementia praecox are unknown to us aside from their clinical course.

A large superstructure of effort aimed toward the prevention of mental diseases — the so-called mental hygiene movement — has been erected on a narrow foundation of knowledge. While mental hygiene in its present state is a definite advance over complete neglect of the problem, most of the results from it are nebulous. The ordinary individual is no more disposed to follow out the suggestions offered than he is to reform physical habits.

The most concrete problem is that presented by neuro-syphilis. Approximately 15 per cent of the male inmates of the insane asylums of the country are there because of syphilis, a disease the incidence of which can be considerably reduced by prophylactic measures and the later manifestations of which may be prevented by proper treatment. Even in this disease where we know the cause and probable course we are still somewhat at a loss because we face not only a relatively simple medical problem, but an extremely complex psychological problem as well. There is probably no disease concerning which we have adequate knowledge that is so much a reproach to the community as is syphilis, owing to the fact that it is bound up with moral and social considerations as well as purely medical ones. When we consider the diverse factors involved, such as economic conditions that render late marriages almost a necessity, the love of excitement, the disintegration of the home, and the changes which the automobile has made in our social life, there is very little

hope of solution of the problem in the near future. Although prophylaxis is effective in many cases the time seems yet far distant when even an appreciable proportion of those exposed to venereal infections will make use of it. However, neuro-syphilis is a late manifestation of the disease and is a reproach to the community which permitted the infection to take place and failed to arrest it before it had progressed too far.

Another type of mental disease with which we are fairly familiar is alcoholic psychosis. There are some striking figures which are given by Myerson [1] and which are reproduced here.

TOTAL FIRST ADMISSIONS DUE TO ALCOHOLIC PSYCHOSES

(*Temporary care cases are included*)

Year	Per cent	Year	Per cent	Year	Per cent
1912	11.33	1917	12.28	1922	6.51
1913	11.81	1918	8.07	1923	7.82
1914	10.42	1919	7.75	1924	8.08
1915	9.5	1920	3.34	1925	8.06
1916	9.8	1921	4.81		

This brings out the interesting observation that alcoholic psychosis, steadily decreasing under war-time prohibition and the early years of the Volstead Act, has been increasing steadily as bootlegging became better organized. How much of this may be blamed on poor liquor is uncertain, but investigations of Reid Hunt and others have indicated that the usual toxic factor in liquor is alcohol rather than the various other substances. Fortunately, most cases of alcoholic psychosis tend toward recovery and so present definitely a lesser problem than do syphilitic cases. The individual suf-

[1] Rosenau, M. J. Preventive Medicine and Hygiene, (5th ed.), p. 436. New York, 1927.

fering from alcoholic psychosis is, however, a serious problem to the community. So far as statistics are concerned, evidently moonshine liquor or the manner of drinking it has practically offset any advantages which might have been brought about by the lessened accessibility of intoxicants. There is little if any proof of the effect of alcohol on the germ plasm and its relationship to feeble-mindedness or mental diseases. Alcoholic psychosis is fundamentally more of a social problem than a mental disease problem, though a large number of the mental disease cases which are preventable with our present knowledge of things are those due to alcohol.

It must be remembered that certain of the mental diseases have a decided hereditary tendency. Probably in dementia praecox, manic-depressive psychosis, and feeble-mindedness it is most important. There are probably other diseases where heredity plays an important rôle, but unfortunately our lack of knowledge is such that we are unable to make any definite statements in this regard. One disturbing factor is that cases of these diseases not infrequently arise in families presumably free from any taint of mental disease. However, there are certain eugenic standards that can be maintained. Among these should be the prevention of marriage of those persons infected with active syphilis. However, it will be a long time before popular sentiment will permit effective enforcement of such a measure, although it is at present established in not a few of our middle-west and Pacific-coast states. However, it is not particularly effective because those who feel that they may run afoul of the law simply have the marriage performed in a nearby state where there are no re-

stricting laws. A second important measure is the sterilization of those feeble-minded who are permitted to leave the insane hospitals, and the sterilization of feeble-minded in the community who have become either socially dependent or delinquent, regardless of whether they are inmates of the state hospital or not. This same rule should apply to the insane and should be further reinforced by making insanity a cause for annulment of marriage.

XIII

DERMATOLOGY

THE time allotted to the specialties in the modern medical curriculum is of necessity short, and consequently the course in dermatology can do little but touch on the more important diseases. However, even in the limited time available, the modes of prevention of some diseases can be brought out, and in discussion of the etiology of others, preventive measures can be brought out by implication.

In the following list are alphabetically arranged those diseases in which there is some opportunity for application of existing knowledge toward prevention, and certain of them are considered in some detail in the body of this article. These latter are chosen with regard to importance, although certain important diseases which are considered in other courses are omitted to avoid undue repetition.

Acne vulgaris
Actinomycosis
Anthrax
Balanitis
Bedbugs
Blastomycosis
Cancer (chronic irritation)
Carbuncle
Chancroid
Chilblains
Clavus
Comedo
Creeping eruption
Dermatitis actinica
Dermatitis medicamentosa
Dermatitis venenata
Diphtheria
Equinia
Erosio interdigitalis saccharomycetica

Erysipelas
Erysipeloid
Exanthemata
Furunculosis
Granuloma pyogenicum
Impetigo contagiosa
Keratosis senilis
Molluscum contagiosum
Pediculosis
Pellagra
Pruritus ani
Pruritus senilis
Scabies
Seborrhea
Sporotrichosis
Sycosis
Syphilis
Thrush
Tinea favosa
Tinea versicolor
Urticaria
Varicose ulcer
Verruca

Acne Vulgaris. The first stage of this disease usually occurs at or about the beg nning of puberty. It is undoubtedly connected in some way with the changes that occur at this period. The earliest stage of acne is the comedo, which is caused by a plugging up of the duct of a sebaceous gland. At the age of puberty there is often a marked sudden increase in activity of the sebaceous glands. The ducts do not increase in size proportionately to this increase in activity and the result is that a duct slightly increased in size has to carry off perhaps twice the amount of sebum. If it is unable to do this, it becomes plugged. Thus a comedo or blackhead is formed.

In the earliest stage of a comedo the sebum is semisolid and drainage of the fluid may be established by washing thoroughly with soap and water once or twice a day, but unfortunately the comedones form usually at an age when children are very careless about washing and if the parents are not watchful the comedones are allowed to remain and harden until many of the ducts

are firmly blocked. Even at this stage the comedones may be readily removed with a watch key or a comedo extractor to establish drainage of the ducts. If the condition is allowed to progress the production of sebum goes on, although the duct is plugged. A papule then forms about the comedo; this papule consists of a mass of sebum which stretches the walls of the gland. The pressure of this retained mass of sebum probably interferes with the blood supply of the gland, thereby lowering its resistance to infection. If in this stage, which may be several years after the beginning of the comedo, the child's resistance is lowered, say by a digestive upset, infection of this gland is likely to take place and inflammation to begin. Pus may form, together with a dilatation of the vessels and we have an abscess of a sebaceous gland — an acne pustule, commonly called a "pimple."

Preventive medicine has a great field in the early stages of acne, for it is in these stages that proper treatment will prevent the unsightly later stages from developing. The objects of treatment are:

1. To obtain adequate drainage of the glands.
2. To raise the local resistance of the skin and the general resistance of the body to infection.

The first is obtained by:

1. Soap and water, with scrubbing in those cases that will stand it.
2. The application of washes or ointments which cause desquamation and thus aid in drainage of the ducts.

The second is obtained by:

1. Stimulating lotions or salves applied to the skin.

2. Measures to raise the general resistance of the body, such as proper diet, exercise, fresh air, sunlight, and the avoidance of constipation.

Impetigo Contagiosa. This disease may be prevented by avoidance of contact, direct or indirect, with persons having the disease. It is obviously helpful not be be shaved by a barber unless all implements are sterilized, although this is an ideal seldom attained. The same prophylactic measure is obviously of value in sycosis vulgaris and furunculosis.

All cases of impetigo contagiosa in children should receive proper treatment and children so affected should be kept out of school until well. The control of head lice among school children has greatly lowered the incidence of this condition.

Furunculosis. Cleanliness and the avoidance of chafing the skin, as by starched collars or rough neckbands, are the most important items in prevention of this condition. Persistent occurrence of boils should lead to a thorough investigation into the mode of life of the patient, in order to correct any obvious hygienic defects, such as constipation or ill-balanced diet. In addition, the urine should be examined for sugar, as at times furuncles are one of the first clinical evidences of diabetes. A furuncle should be carefully treated, with particular attention to not soiling the surrounding skin with infected material. In establishing drainage, it is important to prevent breaking through the abscess wall into the surrounding healthy tissue and so spreading the infection. Finally, the value of autogenous vaccines in preventing reinfection might be touched on.

Tinea, including Favus and all Forms of Ringworm. Contact should be avoided with persons or animals sus-

pected of being affected. In animals such as cats, dogs, horses, and cattle, bald spots are often evidence of tinea. In ringworm of the hands, feet, and thighs, often referred to as epidermophytosis, the infection may be spread by shaking hands, by walking barefoot about shower baths that are used by others, or by wearing jockey straps or underclothes that have become infected. It is a common practice among athletes to use repeatedly, without washing, clothes that have been wet with sweat on many occasions. It is probable that sweat-soaked clothing forms a good medium for the growth of these fungi and that drying does not kill them.

Cases of ringworm should be excluded from school. Ringworm of the scalp should be treated when practicable with X-ray, as it shortens the course of the disease by months or years.

Verruca Vulgaris. That common warts are contagious has been proved beyond question. They are caused by a filtrable virus. In this disease, therefore, contact with those affected is to be avoided. As the most troublesome form of warts is the plantar variety, the custom of walking barefoot about shower baths in gymnasiums and dormitories should be advised against or prohibited. There is little question that the increasing prevalence of this disease in our schools and colleges is due in great measure to this practice. In some of the athletic clubs in Chicago, each member is advised to wear his own wooden shoes while under the shower and while walking about the bathrooms. One foot at a time may be lifted out of the shoe and washed and then replaced in the shoe. Ormsby believes that since this practice has been adopted the incidence of ringworm infections has already diminished and that the same

method would probably decrease the number of cases of plantar warts in our schools and colleges.

Seborrhea. Sabouraud and others believe that seborrhea is caused by a microörganism (the microbacillus of seborrhea). Though this theory is not universally accepted, there is strong evidence that at least some cases of seborrhea are due to an infection, especially those that have a sudden onset and clear up rapidly with antiseptic treatment.

If Sabouraud's theory be true, it is probably likewise true that the organism is an extremely common invader of the scalp, and that few of us entirely escape slight infection with it. If we are to avoid infection with this organism, we should never allow a comb or a brush that has been used on another person's hair to come in contact with our hair, until such comb or brush has been sterilized. We should never wear or try on a hat that has been worn or tried on by another. Whether the benefit of such extreme precautions as these is sufficient to make them worth while may be doubted.

Scabies. Scabies is an itching disease caused by an animal parasite (Sarcoptes hominis). The female burrows into the horny layer of the skin to lay her eggs, while the male lives on the surface of the skin. The itching is probably caused by the burrowing of the female. Scabies in adults is usually acquired by sleeping in the same bed with one afflicted with the disease, though it may also be acquired by sleeping in infected bed linen. In children whose skin is thinner, and occasionally in adults, it may be acquired by shaking hands with an infected individual.

School nurses have done much in the past few years to lessen the incidence of scabies, by watching for its

appearance among the pupils and sending those afflicted to hospitals for treatment.

In treating scabies, it may be necessary to treat whole families, or at least those members who have been exposed to it, even if they do not complain of itching, for the disease does not show itself as a rule in less than a month after exposure.

Pediculosis capillitii, pubis, vestimentorum. The first of this group is more or less prevalent in women and children. Here, too, the school nurses have done excellent work, for children with pediculosis are referred for treatment and not allowed in school again until all the ova have been removed from the hair. Lessening the incidence of this disease has also lessened the incidence of impetigo contagiosa, as this disease is often secondary to pediculosis capillitii.

Pediculosis pubis is most often acquired in venery, though it may be and often is acquired from dirty water-closet seats.

If exposure is suspected a bath with soap and water is usually sufficient to prevent infection.

Pediculosis vestimentorum is rarely seen in this community, though in Central Europe it is extremely common in the lowest classes. Among the ignorant in certain parts of Europe it is even considered a sign of health.

As a war disease it is of vast importance, a fact which army surgeons have been slow to realize, but now that it has been shown by Wolbach that typhus is transmitted by lice and by lice only, preventive measures against lice in future wars will be given a prominence greater than ever before.

Trench fever, a relapsing fever which caused great

loss of man power among the British troops in the Great War, is believed also to be transmitted by lice only.

In military hygiene the most important feature in preventing infection with body lice is not in delousing men who come from the trenches, but in seeing that men entering the lines are free from lice. Lice do not arise *de novo:* they are carried into the lines in the clothing of men entering the lines, and in trench warfare, where no bathing is possible in the trenches, multiplication is rapid.

During the last war it was discovered that body lice may attach their ova to the pubic and peri-anal hair or even to the body hair, so that, even though the men be free from lice, there may be viable ova on these hairs. It may be possible to devitalize the ova by chemical means, but shaving of the pubic and peri-anal hair, as practiced in the United States Army toward the end of the Great War, may be necessary.

XIV

GENITO-URINARY SURGERY

Genito-urinary surgery may be divided roughly into two branches: that dealing with venereal diseases; and that dealing with other disorders of the genito-urinary tract.

The prophylaxis of the venereal diseases is a moot point, both as to advisability and as to efficacy. The statistics from the Army and the Navy in the World War were very favorable to the value of venereal disease prophylaxis if used early and thoroughly. The value of calomel ointment is as yet somewhat uncertain, but in view of the great importance of syphilis from the economic as well as from the medical aspects, it would be well to make use of anything that affords hope of help. The experience with both silver nitrate and potassium permanganate injections in prophylaxis of gonorrhea during the World War showed that these were of definite value up to six hours after exposure. The statistics given by Rosenau [1] show very definitely the value of prophylactic procedures in this disease. Of course, the value of any procedure depends, to a certain extent, on the intelligence and the thoroughness with which it is carried out. Simple soap and water afford entirely effective prophylaxis against soft chancre. Past experience has shown the futility of any attempt by medical inspection or state control of prostitutes, and also the practical impossibility of preventing prosti-

[1] Rosenau, M. J. Preventive Medicine and Hygiene (5th ed.), p. 68. New York, 1927.

tution. Theoretically, instruction in sex hygiene should be of definite value and should be considered in any attempt looking toward prevention of venereal diseases. Certainly the experience of generations has shown that fear is an entirely inadequate type of reaction to invoke.

The campaign for the control of venereal diseases has undoubtedly been seriously hindered by the confusion of the moral and social aspects of the problem with the medical aspects. However, the economic importance of the problem of venereal diseases is so great that no sentimental objections should be given weight if they hinder the control of the disease.

In addition to personal prophylaxis against venereal disease there are certain aspects of epidemiological importance: (1) the prevention of individuals in the communicable stages of venereal disease from handling foodstuffs; (2) emphasis on the danger of the common drinking or eating utensils or towels; (3) the routine use of silver nitrate instillations in the eyes of newborn infants to prevent ophthalmia neonatorum. One important field for consideration is the prevention of epidemics of gonorrheal vaginitis in girls. These epidemics usually occur in institutions and may be avoided by strict cleanliness. Under this heading should perhaps be considered also the various legislative attempts to prevent the transmission of venereal disease through the demand for medical certificates of health before issuing marriage licenses. The value of these laws, however, is open to serious question from the practical standpoint.

Probably the next most important consideration from the point of view of preventive medicine is that of new growths. There are certain types of growths very defi-

nitely associated with occupational hazards. Carcinoma of the bladder in aniline workers is a well-recognized type. Similarly, mule spinners' cancer and chimney sweeps' cancer can be definitely related to the occurrence of certain tarry substances in oil and soot which are soluble in the sebaceous secretion of the scrotal skin and which by their presence give rise to prolonged irritation and ultimately the formation of new growths. Another measure apparently of striking preventive value is circumcision, which is a very definite protection against carcinoma of the penis. Phimosis is one of the chief causes of chronic irritation in the penile region and is an important factor in the formation of new growths. In other tumors of the genito-urinary tract, however, we can do little, as our knowledge is so scanty as to permit no method of prevention; but we can, at least, through early diagnosis and treatment, in many instances prevent more serious damage than might otherwise occur.

Perhaps the most important single point is the early detection and the discovery of the cause of hematuria. This symptom should never be disregarded and every effort should be made to ascertain as soon as possible what is giving rise to it. Once diagnosis has been made, prompt treatment should be instituted.

The second important consideration is the prevention of the train of pathological changes that follow hypertrophy of the prostate. Our ignorance of the etiology of this hypertrophy is such as to preclude any attempt to prevent its appearance. However, the early recognition and treatment of the condition is of great importance. The hydrostatic pressure of the retained urine constantly added to by the secretory activities of the

glomeruli and tubules ultimately results in destruction or at least serious impairment of the kidney substance through compression, and, not infrequently, kidneys are seen in cases of advanced prostatic hypertrophy in which the kidney substance has been reduced to a narrow shell about a greatly dilated pelvis and calices. Whether or not there is infection of the retained urine is not of tremendous importance as destruction of the kidney substance proceeds whether there is infection or not. Of course, pyelonephritis is more apt to develop in those cases where the urine is infected. However, those individuals with retention of uninfected urine are considerably poorer operative risks than those whose urine has been infected, in that they have built up no resistance to the organisms which are sure, sooner or later, to gain access to the urinary tract. The same chain of events that follows prostatic hypertrophy might well follow a stricture, although usually strictures occur in younger individuals, so that the general resistance is apt to be better, and there is no necessity for as serious an operation as in the case of prostatic hypertrophy.

XV

GYNECOLOGY

THERE are two important types of gynecological disorders which are susceptible of prevention. The first of these is the functional group primarily associated with menstruation. Records of industrial concerns show more loss of time from this than from any other disease except the common cold. This group of disorders may be very largely controlled by the use of proper hygiene and specially designed exercises. The work of Mosher was pioneer in this field and contains practically all the essential points. Briefly, the prevention of menstrual disorders hinges on exercises to maintain tonus of the abdominal muscles and to keep the general body condition fit; wholesome, well-balanced diet; and prevention of constipation. This group of cases only infrequently is brought to the direct attention of the physician.

The other very important group of disorders is structural. Two distinct points are to be considered: first, the prevention of annoying disabilities of various types due to a weakened pelvic floor, secondary to birth injuries (included in this group are such preventible disorders as cystocele, rectocele, and prolapse); second, the prevention of disabilities due to another important group again associated with birth injuries, cervical lacerations, which always lead to chronic endocervicitis with its annoying accompaniments, and may, at times, lead to carcinoma of the cervix.

One of the signs which calls for immediate investigation is abnormal vaginal bleeding. All too often this may indicate an early carcinoma, and mere symptomatic treatment is little short of criminal. Even if a polyp or myoma instead of carcinoma is found to lie at the root of the bleeding the condition is one which should be corrected to prevent debilitation.

XVI

OTOLARYNGOLOGY

PROBABLY the most important aural disorder susceptible to prophylactic treatment is otitis media. It is often a result of the contagious diseases of childhood, although frequently diseased tonsils and chronic inflammatory processes which extend up the eustachian tube are a source of trouble. The most generally accepted figures give 15 per cent of school children as defective in one or both ears.

The prophylactic measures are relatively simple. The cases of otitis media following scarlet fever will, of course, decrease as that disease becomes less important, and in the same way the cases following measles may be lessened. As a result of the removal of adenoids and infected or enlarged tonsils the incidence of ascending infections of the middle ear should be considerably reduced. Any discharge from the ear or persistent earache should be at once carefully investigated and proper treatment instituted to prevent further danger to the organ and to prevent involvement of the mastoid cells or the meninges.

The survey by Shambaugh [1] showed that the most dangerous period for development of deafness is before the third year of life, due to otitis media or toxic neuritis of the eighth nerve secondary to the diseases of childhood. Meningitis is particularly important as a cause of deafness. Obviously, prophylaxis must be directed

[1] Shambaugh, G. E. and Others. *Arch. Otolaryng.* 7: 415, 1928.

first against these diseases and second against otitis media.

Defective hearing is so frequently mistaken for stupidity or inattention on the part of a child that tests should be made of the child's hearing before he starts school. The congenital type of defective hearing is not very susceptible to improvement, but children can be considerably helped in school by being seated near the teacher and having the teacher keep in mind the deficiency. A large number of cases can be improved by appropriate treatment.

There are certain types of deafness that offer distinct opportunity for prophylaxis. Long-continued, high-pitched noises almost always lead to deafness. The noise of the riveting machine in structural steel work, and the noise to which boiler makers are subjected are particularly dangerous in this regard.

XVII

OPHTHALMOLOGY

Conservation of vision is becoming a more serious problem, as our civilization causes steadily increasing strain on the eyes, and at the same time forces a large proportion of our population to depend for livelihood on work in which satisfactory vision is an absolute necessity. The lines along which preventive work may be carried out are varied. Most obvious through analogy with other disease problems are the infectious diseases of the eye. Ophthalmia neonatorum has no excuse for existence at the present time, as Credé's method of prophylactic instillation of silver nitrate into the eyes of the infant is a sure preventive of this disorder. In fact it is justifiable to say that neglect of this procedure where there is any chance of gonorrheal infection in the mother is little short of criminal.

However, it is not enough to protect the eyes of the newborn child temporarily, in this way, for if the mother is infected there are other ample opportunities for involvement of the infant's eyes if it is allowed to remain in contact with her. For this reason the infant of a gonorrheal mother should be immediately isolated from her. Another phase of the problem of gonorrheal infection is that in adults. Although the danger is relatively slight, the common wash basin and common towel, particularly in labor camps and lodging houses, are definite sources of danger.

Phlyctenular disease is also of considerable importance in childhood, especially in the tuberculous child.

The prevention of this condition is best handled by general antitubercular measures calculated to build up the resistance of the child, and by protection of the eyes during attacks of acute exanthemata, particularly measles. It has been shown also that the maintenance of proper nutrition is of no inconsiderable value in the prevention of this condition.

Another of the infectious diseases of very considerable importance is interstitial keratitis, one of the manifestations of congenital syphilis. The condition usually appears between the ages of five and fifteen years, but its prevention should begin before the birth of the child, with vigorous antisyphilitic treatment during the course of pregnancy in syphilitic women. The next measure of value is the treatment of those children showing any of the stigmata of congenital syphilis.

Fortunately, through the efforts of our immigration inspectors, we have been able to keep down the amount of trachoma. However, there are certain endemic foci, particularly among the Mexicans and Indians in the Southwest. Trachoma is a communicable disease and may be controlled by two measures: first, by quarantine of the affected individuals; and second, by the protection of the eyes of healthy individuals from any material with which infected individuals may have come in contact.

Closely related to the dangers to vision caused by infectious diseases are those caused by trauma. The most dangerous types of trauma are those reinforced by infection, particularly with the pyogenic organisms. Industry provides the majority of traumatic injuries to the eyes, particularly among those working with grinding and chipping tools. The increased use of goggles has

helped materially to reduce the danger. However, in recognition of the inherent aversion of human beings to taking any more trouble than is necessary, safety devices should so far as possible be placed on the machine rather than on the men themselves. It is important to reinforce the use of safety devices by instruction as to how to care for injuries to the eye, because the chief danger is not so much from the immediate trauma as it is from bacteria finding a portal of entry thereby. Thus, the well-meaning but frequently far-from-skilled help of fellow employees should be discouraged, and emphasis laid on the prompt treatment of any injury to the eye by some person trained and qualified to take care of it. The use of handkerchiefs and rags should be discouraged as these too frequently are loaded with pyogenic organisms.

When we come to the noninfectious diseases, the most important is glaucoma. This is one of the most insidious diseases of those involving the eye. It may appear, in primary form, apparently out of a clear sky, or as a sequel of iritis or injury to the eye. The underlying lesion in all cases of glaucoma is an increase in intra-ocular pressure which causes atrophy and death of the fibers of the optic nerve, ultimately resulting in blindness. In a certain type of the disease, so-called acute glaucoma, this destruction of the optic nerve may be very rapid, but in most cases it is a slow, insidious process involving a considerable period of years. Unfortunately, in the most important type of glaucoma, the noncongestive, there are few early symptoms which the patient can detect, and also few signs for the examining physician. From the point of view of the individual, difficulty in focusing, a misty vision, or need

of a brighter light for reading are perhaps the most valuable early symptoms of glaucoma. Fortunately, if early diagnosis is made, miotic drugs or decompression will serve to prevent further damage from glaucoma. The prevention of the disease itself cannot be attempted until more is understood relative to its causation.

Another of the very important conditions is myopia. Myopia rarely causes total blindness, but frequently does cause serious visual defects which cannot be compensated for by glasses. Unfortunately the condition usually involves both eyes. One of the greatest advances in the conservation of eyesight has been the use of "sight-saving" classes in the schools to retard the progress of myopia. These sight-saving classes are of comparatively recent origin, the first being established in London in 1908, and the first in this country being those in Boston, established in 1913. The purpose of these classes is to preserve the general health and the eye health of the pupils. The nutrition is properly regulated, and ventilation is carefully looked after. Violent exercise is rather discouraged owing to the possible danger of detachment of the retina. In classes the eyes are spared as much as possible and teaching is done by ear rather than by use of eyesight.

It is advisable, before or during the first year of the child's attendance at school, to determine exactly the state of refraction of the child's eyes, and systematic examination should be made of the eyes of primary and grammar school children to correct errors in refraction. Favorable conditions for study are of particular importance. Thus, illumination should be diffuse but sufficient, and preferably over the left shoulder; the desk and chair should be of proper height, and adjusted to the length

of trunk of the child. In schoolbooks large type should be used so far as possible, and the use of highly finished, glossy paper in textbooks should be discouraged. In addition, the hours of study or of reading should be restricted to reasonable limits. Those children found to have errors of refraction of five diopters or over, should be admitted to the sight-saving classes.

One common defect, the danger of which is not universally appreciated, is crossed eyes, because this condition, if not corrected early, will result in practical blindness of the crossed eye. In addition, the binocular vision will be lost, and ability to judge distance and depth seriously impaired. On the appearance of even a slight squint the child should be immediately examined by a competent ophthalmologist. Usually the application of proper glasses will correct the squint early, and preserve the sight. When glasses fail surgery should be promptly resorted to, because if there is too great delay even surgery will not restore binocular vision or normal acuity in the squinting eye.

As many depend on their eyes for livelihood, the problem of eyestrain becomes a serious one.[1] It is usually found in those who use their eyes for many hours daily. The most common symptom of this disorder is headache, and probably a very large proportion of headaches are due to this cause. The prevention of eyestrain depends on proper type of illumination, systematic resting of the eyes, correction of errors in refraction and muscle imbalance; particularly pernicious is reading or working in dim or flickering lights or in intense glare.

[1] Conservation of Sight Pamphlets. Am. Med. Assoc., Chicago.

XVIII

SYPHILOLOGY

The problem of dealing with the prevention of venereal diseases and particularly of syphilis is extremely complicated, on account of the apparent impossibility of divorcing moral from medical considerations. However, if we accept the aphorism that the duty of the physician is to heal and not to judge, the obvious duty of the physician is to advance prophylaxis regardless of moral standards. Whatever may be the instinctive feeling with regard to the occurrence of venereal disease as retributive justice, after all the important thing to do is to prevent its spread. When we consider the large proportion of inmates of our insane asylums who are there because of syphilitic infections, it is obvious that almost no expense would be too great were we assured of an adequate means of stamping out the disease.

Since the discovery of the Treponema pallidum (Spirocheta pallida) by Schaudinn and Hoffman,[1] there has been some possibility of control of the disease. On the basis of the observation that superinfection is impossible in active syphilis Metchnikoff and others have attempted to devise some method of immunization especially through attenuation of the virus. However, these experiments have been unsuccessful. All attempts at passive immunization have been entirely unsuccessful.

The first effort toward control by modern methods was made through including syphilis among the report-

[1] Schaudinn, F. and Hoffman, *Arb. a. d. k. Gsndhtsamte.* **22**: 527, 1905. *Deutsch. med. Wchnschr.* **31**: 1665, 1905.

able diseases. Considerable advance has also been made through publicity so far as individual prophylaxis is concerned, and after all, this is the immediate medical problem, the control of the disease in its broader aspects being primarily a public health function. Continency is the measure of first importance. The use of calomel ointment during the war was fairly successful, but all depends on its prompt and efficient use. Thus Riggs [2] records the results of 5,103 prophylactic treatments with only 81 infections; and of 1,180 treatments during the first hour after intercourse there was only a single infection. The normal expectancy for all types of venereal diseases resulting from promiscuous intercourse not followed by prophylaxis is about one in twenty, and so the obvious advantage of prophylactic measures is well emphasized.

However, it is probable that the most important method of attack on this disease is the specific treatment of the infected individual, because, as Rosenau well says, it is obvious that if all infected individuals are rendered incapable of transmitting their infection, the disease will necessarily disappear. Thus, early recognition and treatment of the disease is, from the public health standpoint at least, the most important prophylactic measure against syphilis.

It is perhaps unfortunate that arsphenamine promptly clears up the more obvious symptoms of the disease so that many individuals do not continue the treatment long enough to give opportunity for a cure, being satisfied merely with relief of symptoms. As a general rule most early syphilis is insufficiently treated.

[2] Riggs, C. E. *Military Surgeon.* **40**: 341, 1920.

XIX

ORTHOPEDIC SURGERY

Unfortunately, much of the work of orthopedic surgery is that of repair rather than of prevention of injury, such as the restoration to function of crippled limbs secondary to poliomyelitis. Nevertheless, orthopedic surgery has some relationship with preventive medicine. As has been brought out earlier in connection with the course in anatomy there are a number of points, perhaps more especially related to posture, that are of importance. These will be worth touching on again.

Probably posture is the most important of these points. To the school child particularly, where subjected to abnormal environmental conditions, posture is of great importance. A large proportion of physical defects are acquired in school, and other defects already present are not infrequently accentuated. The sitting posture in schools is rather more important than the standing, because of the long time spent in sitting and the inactivity of many of the muscles for a long period. There should be periods of relief from sitting, with corrective exercises, scattered through the day. Stooping over the desk is particularly pernicious as it contracts the chest, interferes with respiration and leads to stooped carriage and round shoulders. The desks and chairs should be carefully adjusted as to height, to avoid this, and any defects in height should be corrected.

It is both fortunate and unfortunate that in childhood the tissues are plastic: fortunate in that deformities can be corrected; unfortunate in that they can be

only too easily acquired. One field that has thrown considerable work on the orthopedic surgeon from the point of view of prevention and of correction as well, is the treatment of infantile paralysis where there has been considerable distortion due to unbalanced muscle pull, the so-called contractural deformities. These usually have to be corrected by appliances, and, if taken early, the serious results can be prevented. The correction of such conditions as scoliosis and kyphosis also probably falls in the field of preventive medicine, as there are many defects which are carried in the trail of these conditions. There cannot be a deformity at one point without a compensatory deformity at another point. It is to be seen from the early part of this statement that one of the most valuable fields of the orthopedic surgeon lies in school hygiene, as improper posture reflects itself in every part of the child's body and in his physical well-being. One of the most interesting as well as most extensive studies in this phase of the question is that carried on by Dr. Osgood and his associates on the Chelsea school children over a period of five years, which gives concrete evidence of the value of the prevention and correction of posture defects. Supervision of physical training in the classes in school should also be considered; fortunately, in practically all institutions physical training is required, and the education and background of the directors of the work are such that they fully realize the importance of the prevention and correction of posture defects.

One field rather neglected, unfortunately, but of great importance, is that of foot conditions, particularly with relation to prevention of deformities of the feet by ill-fitting shoes and the prevention and correction of flat-

foot. The statistics from the selective draft in 1917 and 1918 brought out strikingly the large proportion of disability due to foot disorders, many of which had no excuse for existence. Fortunately, the fashion in footwear seems to be inclining toward more sensible types of shoes, and it is to be hoped that this will continue to improve.

Another field of great importance is the prevention of deformities in tuberculosis of the bones, with particular regard to prevention of kyphosis due to Pott's disease. This condition can be prevented almost invariably by proper structural support, together with arrest and healing of the tubercular processes.

XX

INDUSTRIAL HYGIENE

While no one course in the medical curriculum concerns itself directly with industrial hygiene, its steady increase in importance, urged in no slight degree by the Workmen's Compensation Laws, demands at least passing attention, apart from the consideration given in the courses in medicine and surgery. While a large portion of industrial hygiene is of necessity in the nature of first-aid work, it nevertheless has a very wide field in the prevention of accidents and disease and in the prevention of complications of lesions already existing. In fact, in its widest sense, industrial hygiene resolves itself into maintaining the welfare of employees, who make up the majority of the adult population. Wages and the resultant economic status of the employee are of great influence on health.

In dealing with the industrial diseases it is particularly important to be conversant with all the details of a worker's occupation, as otherwise it is impossible to recognize the dangers by which he may be confronted. This knowledge is of course necessary to outline intelligently preventive measures. With the growing complexity of modern industry it is no longer enough to know that the man is a laborer or a mechanic. To take even as well-known a trade as painting, obviously the industrial hazards are entirely different if the man is doing ordinary painting than if he is working with a spray gun, and if he is using various types of varnishes and lacquers, as well as lead-containing paints. It is par-

ticularly important, once the hazards of the man's occupation are recognized, to give him information in how best to avoid these particular hazards, so that he may concern himself not only with more obvious methods, such as protection from injurious dusts or fumes, but also with such matters as diet, cleanliness, and the like, which are all too apt to be neglected.

One very important and basic field of industrial hygiene is the maintenance of proper working conditions with regard to light, ventilation, humidity, and temperature. The maintenance of a satisfactory supply of air and light is probably worth more than any other factor in the prevention of respiratory diseases. The relation of poor illumination to industrial accidents has long been known, and scarcely needs to be touched upon. Such obvious occupational problems as lead poisoning,[1] carbon monoxide poisoning, and caisson disease have been fairly well taken care of, or at least have been well recognized.

A field that has not yet been developed as it should is that of the control of infection and particularly respiratory disease in industrial groups.[2] The problem of the common cold is particularly pressing, as a great amount of time is lost from this one condition. While its etiology is unknown, its behavior is that of an infectious disease and many shops and offices offer ideal opportunity for its dissemination. Various methods for its control have been attempted; perhaps in the final analysis the relatively costly method of keeping at home those employees suffering from colds may prove to be

[1] Aub, J. C. and Others. "Lead Poisoning." Medical Monographs. vol. vii. Baltimore, 1926.

[2] *U. S. Public Health Report* **41**: 113, 1926.

most reasonable and economical. In the meantime, much can be done with proper ventilation and prevention of close contacts.

In this connection, the steady progress made by ventilating engineers in controlling the various dust hazards is deserving of mention. Perhaps more important than generally recognized is the need of easy control of ventilating ducts, vents, and the like, which should be made readily accessible to the workmen and adapted to their specific needs.

The great importance of prompt, expert care of wounds to prevent their infection has already been touched upon under the heading of surgery, but it cannot be mentioned too often. An infected wound is invariably more dangerous and slower in healing than a clean wound, and the end results are usually less satisfactory. A properly organized emergency clinic is no mean asset.

In industrial medicine an opportunity is afforded to apply the advances of medical science to the welfare of large groups as well as individuals, conferring advantages and responsibilities similar to those of the health officer on the industrial physician.

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